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MURGUÍA (J.). **Cinco meses de lucha contra la langosta Julio 28–Diciembre 24 de 1947.** [Five Months' Control of the Locust from 28th July to 24th December 1947.]—*Publ. Direcc. Agron. Uruguay*, no. 92, 64 pp., 4 maps. Montevideo, 1948.

Swarms of locusts [*Schistocerca*] entered Uruguay from the west and north at the end of May 1947 and rapidly spread over the whole country. The author was appointed two months later to organise a control campaign and here gives details of the way in which this was done, the materials and equipment used and the districts in which operations were required. Most of the work was carried out by mobile squads supplied with motor transport, and aeroplanes were used for scouting. The methods employed included dusting with 12 per cent. technical BHC (benzene hexachloride containing 12–13 per cent. γ isomer) against the adults, which was regarded as the principal measure, and spraying with 3·5–5 per cent. BHC, distributing baits poisoned with BHC or other toxicants and using flame-throwers against the hoppers. Barriers were also used against the latter, but less to protect crops than to surround hopper bands prior to their destruction. The locusts were prevented from causing damage and were completely controlled in five months, the harvest being one of the best in recent years.

CHAO (Hsiu-fu) & CHEN (Chin-chen). **Observation of two important Insect Pests (Aphid and Army-worm) found on Wheat and their natural Enemies.** [*In Chinese.*]—*Fukien agric. J.* **9** no. 1–2 pp. 23–31, 1 fig. Foochow, 1947. (With a Summary in English.)

The most important pests of wheat in Foochow are *Macrosiphum avenae* (F.) (*granarium* (Kby.)) and *Leucania* (*Cirphis*) *unipuncta* (Haw.), though it is also attacked by six species of Jassids, a list of which is given. *L. unipuncta* was found feeding on the leaves at night and, very occasionally, during the day, and *M. avenae* was abundant on the ears. The insects predacious on this Aphid comprised eight Coccinellids which, however, also preyed on each other and so did not increase rapidly, and Syrphids and a species of *Chrysopa*, which were of minor importance. Studies of the rate of development in spring of an unidentified Coccinellid and *Coccinella septempunctata* L., *C.* (*Harmonia*) *axyridis* Pall., *Coelophora biplagiata* (Swartz) and *Propylaea japonica* (Thnb.), which were the species active then, showed that the duration of the life-cycles ranged from about 30 to 46 days ; the details are given in a table. The Aphid was parasitised by the Braconids, *Aphidius* (*Lysiphlebus*) *japonicus* Ashm. and *Ephedrus japonicus* Ashm., and by a Ceraphronid, tentatively determined as *Lygocerus koebelei* Ashm.

Larvae of *Leucania unipuncta* were preyed on by *Carabus* sp. and parasitised by *Apanteles* sp., *Meteorus* sp., *Rogas* (*Rhogas*) *fuscomaculatus* Ashm., *Apanteles ruficrus* (Hal.), unidentified Hymenoptera and a Phorid of the genus *Megaselia*, which were responsible for 28·8, 26·9, 9·6, 1·9, 13·5 and 1·9 per cent. parasitism, respectively. All the Hymenoptera attacked the larvae when they were 5–19 mm. in length, but *Megaselia* not until they reached a length of 35–40 mm.

LUH (P. W.) & WOO (F. C.). **A general Investigation of the Locust Outbreaks in China during the Year 1946.** [*In Chinese.*]—*Spec. Publ. nat. agric. Res. Bur.* no. 31, [1+] 16 pp., 1 map, 2 fldg. tables. Nanking, 1947. (With a Summary in English.)

In 1946, outbreaks of *Locusta migratoria manilensis* (Meyen) were widespread in Kiangsu, Anhwei and Honan and also occurred in Kiangsi, Hupei, Shansi, Hopei and Shantung, as well as in Formosa, to which infestation probably spread from the Philippine Islands. In addition to the breeding grounds previously reported [*R.A.E.*, A **25** 62], oviposition took place over a vast area of the Yellow River Valley in Honan and Anhwei, which had become favourable for breeding because the destruction of a dyke in Honan in 1938 caused the land to become submerged or overgrown with willow and reeds. Locusts from this region have migrated to Shensi and Shansi in years of heavy infestation. The summer generation was present from early April until the middle of July and the autumn one from June to early September. The damage was considerable and was greatest in late April and early July, wheat and sorghum (kao-liang) being more severely injured than rice, maize and reeds. Hand-collection and destruction of all stages was the chief measure adopted, but flame-throwers and a spray of oil or calcium arsenate were also employed to a limited extent.

Ceracris kiangsu Tsai occurred only in Szechwan, Hunan, Kiangsi and Fukien, but it caused considerable losses of bamboo, maize, rice and other crops.

The distribution of both species during the year is shown on a map.

Goodey (T.). **Soil and Freshwater Nematodes. A Monograph.**—8½×5½ ins., xxvi+390 pp., 191 figs., 7½ pp. refs. London, Methuen & Co., Ltd.; New York, N.Y., J. Wiley & Sons, Inc., 1951. Price 45s.

This work is designed to provide a comprehensive account of the free-living nematodes that occur in soil, humus, decaying plant tissue, fresh water and, occasionally, in special association with insects. In the main, it comprises an illustrated description of a characteristic species (usually the genotype) of each of the numerous genera dealt with, a list of the other species, and brief biological notes.

In most cases in which the nematodes are associated with insects, the latter serve mainly as a vehicle for their dispersal to new feeding grounds. Only a few of the genera considered include species injurious to insects, examples cited being *Diplogaster labiata* in *Eutetrapha* (*Saperda*) *tridentata* (Ol.), *D. aerivora* in *Heliothis armigera* (Hb.) (*obsoleta* (F.)), some species of *Aphelenchoides* in bark-beetles, and a very few of the Mermithids that parasitise various insects, almost all of the members of this family that have been recorded from insects being omitted from the list of species because the adults are unknown. A very brief account of the appearance of Gordiids, the larvae of which parasitise insects and which may be confused with Mermithids, and the distinctive characters of the four British species are given in an appendix.

Hamilton (A.). **The Blackberry Mite** (*Aceria essigi*).—*N.Z. J. Sci. Tech.* **31** (A) no. 2 pp. 42–45, 2 figs., 10 refs. Wellington, N.Z., 1950.

Aceria essigi (Hassan) was observed for the first time in New Zealand in 1946, when it was found infesting wild blackberry at Nelson; it has since been recorded on that plant in both islands. Keifer's redescription of the mite [*R.A.E.*, A **30** 555] is quoted and its bionomics, world distribution, food-plants and control are reviewed from the literature.

Morris (D. S.). **Codling Moth, Light-brown Apple Moth and Orchard Mites. Control Experiments in the Goulburn Valley.**—*J. Dep. Agric. Vict.* **48** pt. 8 pp. 378–382, 6 figs. Melbourne, 1950.

As parathion (diethyl p-nitrophenyl thiophosphate) had shown promise against the codling moth [*Cydia pomonella* (L.)] and the light-brown apple moth [*Tortrix postvittana* (Wlk.)], as well as the bryobia mite [*Bryobia praetiosa* Koch] and the red spider [*Tetranychus telarius* (L.)] on pear in the Goulburn

Valley of Victoria [*R.A.E.*, A **38** 169], large-scale tests were undertaken in 1949–50 to compare sprays of 0·015 or 0·0075 per cent. parathion alone and 0·0075 per cent. parathion with the addition of 0·05 per cent. DDT or 0·3 per cent. lead arsenate with a spray of 0·05 per cent. DDT and 0·3 per cent. lead arsenate. All sprays were applied twice, on 2nd November and 6th December.

Against *Cydia*, which was rather more injurious than of late years, possibly owing to the recent practice of employing reduced spraying schedules, all treatments gave significant control, reducing the percentages of infested fruit to 0·2–1·3 as compared with 6·3 for no treatment, with no significant difference between them. Against *Tortrix* also, all treatments gave significant control, but the two including lead arsenate, which reduced the percentage infestation to 0·4 as compared with 17·2, were considerably better than the others (6·4–8·4 per cent.), though the difference reached significance only in the case of 0·0075 per cent. parathion alone. Large numbers of larvae were present throughout the season, and this is attributed in part to the occurrence of spring breeding on a prolific cover crop [*cf.* **38** 169], which could not be ploughed under because of continued wet weather in October–November.

Some of the trees had been sprayed against eggs of *Bryobia* in the previous July, and the numbers of this mite per 480 leaves in October were 4, 19 and 80 on those sprayed with 1 gal. red oil in 15, 20 and 25 gals. water, 20 on those sprayed with lime-sulphur (1 : 10) and 2,764 on untreated trees. *Tetranychus* had not appeared on the trees at this time. The trees were examined for mite damage in February, and some that were not treated in winter or summer showed severe injury. There was no evidence of any severe damage on trees sprayed with parathion, whether or not they had been sprayed with ovicides, though small colonies of *Tetranychus* were present, but infestation was considerably heavier on the trees treated with the spray of DDT and lead arsenate.

The residues of parathion on fruits sprayed with it at 0·015 and 0·0075 per cent. were 0·7 and 0·5 part per million, respectively.

CHIAROMONTE (A.). **Il problema della sesamia nella Somalia Italiana.** [The Problem of *Sesamia* in Somalia.]—*Riv. Agric. subtrop.* **42** no. 1–3 pp. 42–47. Florence, 1948. (With a Summary in English.)

The author recalls that in 1925–26, when he was working in Somalia, *Sesamia cretica* Led. was present in small numbers on maize but not at all on sugar-cane. Incomplete observations on its life-history showed that the pupal stage lasted 17 days in July and August, and larvae were found in January and July. The larvae were parasitised by *Apanteles ruficrus* (Hal.) and appeared to cause very little injury. The species received little notice in the succeeding years, but in a letter accompanying his report for the last quarter of 1946, A. Forlani stated that it had caused such severe damage that control measures were urgently required. In view of this, the author reviews from the literature its life-history and habits in the Anglo-Egyptian Sudan [*cf.* *R.A.E.*, A **29** 387], where it is a pest of maize and sorghum, and Egypt [*cf.* **4** 254], where it is of most importance on these crops but also attacks sugar-cane, though eggs do not appear to be laid on this last, and gives a list of its parasites. It is not known from other parts of Africa. Two crops of maize and sorghum are grown each year in Somalia, in April–May and September–October (the two rainy seasons), and require about 90 days to maturity, so that 2–3 generations might have time to develop, while sugar-cane fields are not broken up for 2–3 years and would thus permit continuous development. It is therefore not surprising that infestation has increased. Pending further investigations on the moth and its food-plants in Somalia, the author recommends the use of trap-crops of maize, crop rotation and resistant varieties.

Omer-Cooper (J.), Whitnall (A. B. M.) & Fenwick (E. M.). **Notes on four Species of Coleoptera attacking Turf in the eastern Cape Province.**—*S. Afr. J. Sci.* **44** pp. 125–134, 2 figs., 15 refs. Johannesburg, 1948.

The following is based largely on the authors' summary. Turf composed chiefly of *Cynodon dactylon* on four golf courses on a narrow strip of coastal veld 400 miles long in the eastern Cape Province has been severely damaged and in some cases denuded by Lamellicorn larvae [*cf. R.A.E.*, A **29** 614]. Each golf course has its own particular species, and although their habits differ, they all cause similar damage by feeding on the roots. The correct identity of the four species is obscure ; they comprise three Melolonthids and a Dynastid. Only one, *Macrophylla pubens* Pér. from Humewood, Port Elizabeth, has been studied in detail, and its life-cycle lasts about two years. Adults emerge every year, but major flights occur only every other year. Extensive applications of lead arsenate to the turf at 1 oz. per sq. yard in 1942 apparently gave effective control, as no damage was observed during the succeeding four years. One of the other species (the Dynastid) was also successfully controlled by means of lead arsenate, and damage by a third, which had continued for some years, was unexpectedly brought to an end by an ibis (*Hagedashia hagedash*), which flocked to the infested areas and destroyed the larvae.

Bradford (B.). **The Biology of *Anomala vetula* Wied. an Arthropod Pest of Turf in South Africa.**—*S. Afr. J. Sci.* **44** pp. 135–147, 3 figs., 1 graph, 21 refs. Johannesburg, 1948.

Anomala vetula (Wied.), all stages of which are described, was found infesting turf at an aerodrome in the eastern Cape Province in 1943 ; the damage was not severe, but 48 larvae were found beneath an area of 6 sq. ft. in November. In view of its potential importance as a pest [*cf.* also *R.A.E.*, A **29** 614], its bionomics were studied during 1944–45. Data obtained in the field and laboratory indicated that the egg, larval and pupal stages last 16–47 days, about 20 months and 8 months, respectively, and complete development requires two or three years, depending on the length of the prepupal stage, which is very variable. The larvae feed on small roots, and as a result, soft spongy areas develop in the turf, and in dry seasons the grass in these patches turns brown. The prepupal and pupal stages are passed in earthern cells at a depth of 9–12 ins. The adults are present from the end of December until late February or early March. They remain in the soil at a depth of 4–6 ins. during the day and fly at dusk. They are not attracted to light and were not observed to feed. Oviposition begins 3–8 days after mating, and continues over a period of two months. The eggs are laid in the soil at a depth of 6 ins., and the maximum number deposited by one female was 35 over a period of 20 days. Eggs laid by unfertilised females were not viable.

Groves (J. R.). **A Synopsis of the World Literature on the Fruit Tree Red Spider Mite *Metatetranychus ulmi* (C. L. Koch, 1835) and its Predators, with a brief Review of the Problem by A. M. Massee, D.Sc., F.R.E.S.**—180 pp. London, Commonw. Inst. Ent., 1951. Price 20*s*.

This comprehensive bibliography is primarily concerned with the fruit-tree red spider, currently known as *Metatetranychus ulmi* (Koch) or *Paratetranychus pilosus* (C. & F.), but also includes references to closely related mites that are likely to be of interest in connection with it. The bibliography is in two sections, each arranged alphabetically by authors; the first includes upwards of 800 papers on the mites themselves and the second some 200 (not all of which are additional) on the arthropods predacious on them. The title of each paper is followed by a list of the species dealt with and an outline of the contents, classified where possible under the headings of systematics, bionomics, dispersal, distribution, hosts, varietal resistance, damage, culture, weather, control and technique. Lists of acaricides used are often included under the heading of control, with, in some cases, an indication of their efficiency. Mention is also made of treatments that have favoured mites or affected their predators. The names under which the mites, insects, plants and chemicals are cited are those used by the authors of the papers, but the bibliography is preceded by a list of the synonyms and popular names of the principal Tetranychids. In it, *M. ulmi* is the name adopted for the principal species and *Tetranychus telarius* (L.) is used for the common polyphagous red spider, of which *T. bimaculatus* Harvey as well as *T. urticae* Koch and *Epitetranychus althaeae* (von Hanst.) [*cf. R.A.E.*, A **13** 3; **30** 600] are regarded as synonyms.

An index covering both parts of the bibliography is appended. It is arranged by subjects, but includes references to the predators, plants and chemicals and to the original descriptions of some of the Tetranychids. References that are to papers not concerned with the fruit-tree red spider are indicated by a difference in type.

Despite its brevity, Massee's introductory review of the problem (pp. 3–7) is so concise as to be comprehensive. In it, he draws attention to the principal papers on the subject as a whole and on individually important aspects of it. In this way, he not only provides a cross section of the main papers in the bibliography, but also shows the value of the system of headings under which the contents of the papers cited in it are grouped.

McGregor (E. A.). **Mites of the Family Tetranychidae.**—*Amer. Midl. Nat.* **44** no. 2 pp. 257–420, 45 pls., 22 figs., 26 refs. Notre Dame, Ind., 1950.

The Tetranychids dealt with in this revision are mainly, but not exclusively North American. Apart from a brief introductory section on the morphology of the mites, some features of their bionomics, and the collection and preparation of specimens, it comprises keys to the genera and species and descriptions of the latter, with records of their food-plants, distribution and type localities. Four new genera are erected; they include *Simplinychus*, of which the type and only species is *Neotetranychus buxi* Garm. [*cf. R.A.E.*, A **23** 312], and *Pseudobryobia*, to which *Petrobia drummondi* Ewing [**14** 294] is transferred. *Anychus* is made a synonym of *Eutetranychus*, as *Tetranychus banksi* McG., the type of the former [**8** 145], is also designated the type of the latter. In a note on generic classification, the author points out that the marked variations in structural characters within the family make it necessary to select one character for particular use in differentiation, and concludes that the structure of the tarsal claw and the associated appendages is best suited for the purpose. On this basis, the genera *Paratetranychus*, *Oligonychus* and *Metatetranychus* appear to constitute a three-genus complex, and some have consequently considered *Paratetranychus* a synonym of *Oligonychus*. As, however, the original description of *Oligonychus* was vague and contained no mention of certain typical characters of *Paratetranychus*, the author considers *Oligonychus* at present unrecognisable and includes in *Paratetranychus* all the species of the complex known to him. He does not consider *Metatetranychus* distinct, as the character on which it was based shows no correlation with other structural characters within the complex. He also retains the name *P. pilosus* (C. & F.) for the species of this genus common on deciduous fruit trees, as he considers

T. ulmi Koch, with which some identify it [*cf.* preceding abstract] to be unrecognisable.

The species of *Tetranychus* commonest in the United States is considered to be *T. bimaculatus* Harvey. It is usually recorded from soft-tissued plants, but is differentiated from the species common on such plants in Europe [*cf.* preceding abstract]. The name *T. althaeae* von Hanst. is, however, adopted for the latter in preference to *T. telarius* (L.) or *T. urticae* Koch, on the ground that *T. urticae* is unrecognisable and that *T. telarius* should apply to another European species [but *cf.* **13** 3]. The author does not here include America or Hawaii in the distribution of the mite he calls *T. althaeae* [*cf.* **30** 601], but states that a species that may be identical with it occurs in the United States.

The 36 new species described include *Tetranychus caribbeanae* on cassava in Haiti, Porto Rico and St. Kitts ; *T. equatorius* on groundnut, bean and watermelon in Hawaii ; *T. hicoriae* on pecan in the United States ; *Septanychus braziliensis* on quince and banana in Brazil ; *S. canadensis* on apple in Ontario ; *S. deserticola* on cotton and other plants in California ; *S. deviatarsus*, which attacks various plants, including carrot, celery and castor bean [*Ricinus communis*], and occurs in the United States and Hawaii ; *S. mexicanus* on orange in Mexico ; *S. texazona* on carrot, cotton and turnip in the United States ; *Paratetranychus hawaiiensis*, found on loquat and *Litchi* and in Hawaii and Antigua ; *P. newcomeri* on pear in Washington ; and *P. platani*, which attacks many trees, including camphor [*Cinnamomum camphora*], loquat, and walnut, in California, and is the mite recorded in that State as *P. ilicis* (McG.) [**28** 14].

Divarinychus floridensis McG. [**19** 266] and *Stigmaeopsis celarius* Banks [which are the types of these genera] are transferred to *Schizotetranychus*, and *Schizotetranychus latitarsus* Ewing [**6** 22] is considered a synonym of *S. celarius*. *Eupalopsis pavoniformis* Ewing [**10** 354] is transferred to *Tuckerella*, *T. ornata* (Tucker), the type of the latter genus, being made a synonym of it.

BALCH (R. E.) & UNDERWOOD (G. R.). **The Life-history of** *Pineus pinifoliae* **(Fitch) (Homoptera : Phylloxeridae) and its Effect on White Pine.**—*Canad. Ent.* **82** no. 6 pp. 117–123, 5 figs., 3 refs. Guelph, Ont., 1950.

In view of the injury done to white pine (*Pinus strobus*) in New Brunswick and Nova Scotia in recent years by *Chermes* (*Pineus*) *pinifoliae* Fitch, a study of the life-history of this Aphid was begun in 1948. Previous scanty knowledge on the subject is reviewed. The Aphid was studied in the field and in cage cultures on potted trees. The results showed that the fundatrix overwinters on red spruce (*Picea rubra*), at the base of the buds. Development begins before the buds swell and eggs are laid before bud-burst. Gall formation begins as a result of the feeding of the fundatrix. The eggs hatch at about the time that normal buds begin to burst, and the young gallicolae settle at the bases of the developing needles. They reach the fourth instar and the galls turn brown and open about mid-June, but small galls with few or no gallicolae in them occasionally remain green and closed throughout the summer. The adult gallicolae fly to the needles of white pine, usually of the previous year's growth. They oviposit, and their young crawl to the new shoots in early July, insert their stylets in the axes and remain dormant in the first instar until spring. Mortality is high in this stage. During the first week of the following May, they develop into wingless exules and winged sexuparae. The exules oviposit about the beginning of June, and their progeny settle on the new shoots and produce another generation by mid-July. Further development was not observed, and it is not known whether exules continue indefinitely on pine, but observations suggested that they eventually either die out or give rise to sexuparae. The winged sexuparae leave white pine at about the end of May and settle on the old needles of red spruce. Their eggs were observed as early as 31st May, and the young sexuales that hatch from them as early as 5th June. These develop into adult males and females. They leave the needles at the end of June, and presumably settle on the twigs, though none was found. No pairing or oviposition was observed. Mortality of eggs and young of the sexual generation was high.

C. pinifoliae was unusually abundant on white pine over about 100 sq. miles in New Brunswick in 1942 [*cf. R.A.E.*, A **32** 147], many of the current year's shoots being covered with first-instar Aphids. The previous year's needles bore large numbers of dead winged adults. Galls were numerous on neighbouring red spruce. Red pine (*Pinus resinosa*) and white spruce (*Picea glauca*) were not infested. A similar outbreak occurred in Nova Scotia [*cf.* **32** 110]. Infestation was less severe in 1943–46 [*cf.* **32** 327; **34** 129], but increased again in 1947, causing severe and widespread killing of new shoots of white pine. Infestations were found as far north as Matapedia, Quebec, and as far south as Saint John, New Brunswick, but no reports of increased damage were received from Nova Scotia. There was a general reduction in 1948, probably as a result of high mortality caused by the killing of shoots, the severe winter, and the activities of predacious Syrphid and Agromyzid larvae, which were numerous, especially in the galls. Mortality among adult sexuparae was also high.

The main damage is to white pine, and is caused by the insertion of the stylets into the new shoots by the offspring of the gallicolae. It is possible that they inject a toxic substance before becoming dormant. When the shoots are killed, they droop in midsummer and turn red. Spruce is little affected, as injury due to the galls does not cause much loss of growth and is easily repaired by growth from uninfested buds.

Two sample plots were set up in young stands in the infested area in New Brunswick in 1947. The stands were 20 and 40 years old, and the trees in them had breast-high diameters of 1–4 and 1–9 ins., respectively. In September 1948, 4 per cent. of the white pine in the younger stand had died and 26 per cent. showed scanty foliage at the ends of the twigs, but new growth had developed and most of them seemed likely to recover. In the other, 18 per cent. of the white pines had died, but all of these were less than 5 ins. in diameter; 61 per cent. were severely injured but putting out new shoots. Injury on the remainder was less serious. The loss of growth in infested stands is the most important result of infestation and will probably average five or more years of normal growth without further attack. This will favour competition by spruce and red pine and will reduce the proportion of the valuable white pine in the stands.

APPLE (J. W.) & DECKER (G. C.). **Corn Borer Control on Sweet Corn with concentrated Sprays.**—*J. econ. Ent.* **43** no. 4 pp. 407–414, 3 refs. Menasha, Wis., 1950.

The following is based on the authors' introduction and summary. As concentrated sprays of DDT and oil, applied by aeroplane, have given promising control of *Pyrausta nubilalis* (Hb.) on maize [*cf. R.A.E.*, A **37** 153, 154], four experiments were carried out on sweet maize in Illinois in 1947 and 1948 to evaluate concentrated spray formulations and methods of applying such sprays with ground equipment. Ground equipment was used in order to reduce the plot size and quantity of spray necessary, and it was found that the results would be applicable to maize spraying with equipment adapted from typical weed sprayers as well as to aerial application of concentrated sprays.

The concentrated sprays were usually applied at the rate of 3 U.S. gals. per acre. Concentrated sprays providing 1·5 lb. DDT per acre did not give such good control of the first generation as the same amount of DDT in dilute emulsion sprays applied at the rates of 10 and 50 U.S. gals. per acre, although statistically there was no real difference between them. Against the second generation, certain formulations of DDT applied as concentrated sprays gave control as good as that from the diluted sprays. The concentrated sprays containing DDT were oil solutions and water emulsions. Although there was no significant difference in control with DDT in oil solutions and in emulsified solutions, the oil solutions seemed to offer a slight advantage. Solutions of DDT prepared with five different base oils gave approximately the same control. Velsicol AR–60 gave more effective control than eight other co-solvents of DDT used in oil sprays, but was also the most phytotoxic.

Parathion in oil solution was the only toxicant found to be more effective than DDT in concentrated spray form. Oil solutions of DDD (dichlorodiphenyl dichloroethane) and aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-diendomethanonaphthalene] were approximately equal to comparable sprays of DDT. Oil solutions of toxaphene, heptachlor [1(or 3a),4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-4,7-endomethanoindene] and chlordan were decidedly inferior to DDT. Ryania extractives in water and oil solutions and as a water emulsion gave very erratic results, and emulsion concentrates of rotenone, alone and with pyrethrins, each containing 8 per cent. piperonyl butoxide, did not give satisfactory control at the dosage levels tested.

Emulsions were less injurious than oil solutions to maize foliage, and the presence of a co-solvent in an oil spray intensified the injury ; methylated-napthalene co-solvents tended to be more deleterious to the maize than carbon tetrachloride or cyclohexanone.

Limited tests with an experimental hydraulic-pneumatic atomising sprayer showed that this method of applying concentrated sprays might offer some advantage over a typical hydraulic sprayer for the control of the second generation. Sprays applied with hollow-cone and fan-spray nozzles gave approximately the same control.

Chiang (H. C.) & Hodson (A. C.). **Stalk Breakage caused by European Corn Borer and its Effect on the Harvesting of Field Corn.**—*J. econ. Ent.* **43** no. 4 pp. 415–422, 6 refs. Menasha, Wis., 1950.

There are at least four ways in which the European corn borer [*Pyrausta nubilalis* (Hb.)] may damage maize ; the boring and feeding of the larvae interfere physiologically with plant growth, their feeding destroys the seeds, their boring in the stalks and ear shanks weakens the plant structurally and causes stalk breakage and ear dropping, and they create avenues for the entrance of rots. The relative importance of these types of damage depends on such factors as the stage of growth at which the plant is attacked, the variety and the farming practice. An investigation of the relations of stalk breaking to ear dropping and to the mechanical picking of field maize, and the effects of planting and harvesting time on them was carried out in 1948 and 1949 in an area in Minnesota in which infestation is heavy and the moth has two generations a year. The results are given in some detail ; the following is based on the conclusions drawn from them. Although stalk breakage affects the growth of the ear in different ways, depending on the time it occurs and its position, it was usually insignificant before plant maturity in the field even with a fairly heavy infestation. Its incidence increased rapidly after the plants began to dry, the rate of increase varying with planting dates and with the corresponding levels of infestation. Stalk breakage above the ears had little effect on picking efficiency, but when it occurred below them, the chance that the ear would be picked by a mechanical picker was least when the breaking point was lowest.

In field tests, it was found that the picking quality of ears on broken stalks decreased as the season advanced, and because of this decrease and of the higher percentage of broken stalks and dropped ears found late in the season, the harvest loss on a late picking date was about twice as great as that of an early picking. As ear weight showed no noticeable increase from the time of plant maturity to the time of the second picking and the moisture content changed very little between the first and second picking, picking at the earliest date safe for storing seems advisable to reduce the harvest loss and the labour cost of gleaning. It was also found that the net yield for early and late planting was not significantly different ; although the late planting yielded more as a result of lighter injury from the first generation, it showed a greater harvest waste. Much of the latter can be recovered by gleaning or by turning livestock into the field, and it seems reasonable to conclude that the early planting suffers greater permanent damage and that late planting results in heavier recoverable losses. Where a light infestation by the second generation can be expected or where gleaning is profitable, late planting would be preferable if the length of the growing season permits it.

ARBUTHNOT (K. D.). **Status of European Corn Borer Parasites in the United States.**—*J. econ. Ent.* **43** no. 4 pp. 422–426, 3 figs., 2 refs. Menasha, Wis., 1950.

The results are given of observations made since 1936 [*cf. R.A.E.*, A **26** 729] and particularly in 1944–47 on the establishment, maintenance and dispersion of parasites of *Pyrausta nubilalis* (Hb.) in the maize-growing areas of the United States. Colonisation after 1936 was limited almost entirely to exotic species that had become established in the United States from earlier importations.

Lydella stabulans grisescens R.-D. is widespread in the eastern States, having spread to many areas in which it was not colonised, but parasitises only a small proportion of the larvae in Massachusetts, Rhode Island, Connecticut and New York. It occurs throughout an area of about 22,000 square miles in the Middle Atlantic States, where it parasitised about 13 per cent. of the borers examined late in 1947, and has persisted and parasitises 10–30 per cent. in three localities in the Lake States, in which it was colonised and established before 1936. It has been colonised in nine North Central States since 1944 and recovered in all of them, with a rate of parasitism of 13–56 per cent. in places.

Angitia (*Horogenes*) *punctoria* Roman is widely distributed in southern New England and central and north-eastern New Jersey and was found in one locality in western New York. It was colonised and recovered before 1938 in Indiana, Michigan and Ohio, and has been extensively colonised since 1944 in the North Central States, but apparently has not persisted. *Phaeogenes nigridens* Wesm. is the only established exotic parasite that attacks the pupa. It has persisted in eastern Massachusetts, where it was first colonised in 1924, and was collected there in 1945 for colonisation in Iowa, where it has not been recovered.

Macrocentrus gifuensis Ashm. was the most widely distributed and numerous parasite in southern New England in 1947, and except in central Massachusetts, parasitised 20 per cent. of the borers in 1945–47. It was colonised extensively throughout the North Central States in 1944–47 and is known to have persisted in one area in Iowa. It was colonised and recovered in southern Delaware and southern New Jersey in 1946, but not found in 1947. *Chelonus annulipes* Wesm. was released throughout the Eastern and Lake States and has persisted for several years in some places. It was released but does not appear to have persisted in the North Central States.

Eulophus viridulus Thoms., the only ectoparasite and the only one known to attack native insects, has been collected every year since 1938 near the western end of Lake Erie in Ohio, where it was colonised in 1931 and 1932, and was recovered in 1945–47 from counties of Indiana, Wisconsin and Ohio in which it was never released, but not from localities in which it was liberated. It disperses to great distances from release points and fails to concentrate in any one place. The easternmost recovery was made in 1946–47 in western New York, where it was colonised in 1931.

The native parasites, *Agathis* (*Bassus*) *agilis* (Cress.), *Zenillia* (*Aplomya*) *caesar* (Aldr.) and *Pyraustomyia penitalis* (Coq.) were frequently reared from *Pyrausta nubilalis* in 1946–49. *Pyraustomyia* was taken in the greatest number of localities, but *Agathis* and *Zenillia* were more prevalent in New England, New York and northern New Jersey. All native parasites combined accounted for less than 1 per cent. of the borers observed.

KLOSTERMEYER (E. C.). **Effect of Soil Fertility on Corn Earworm Damage.**—*J. econ. Ent.* **43** no. 4 pp. 427–429, 1 fig., 10 refs. Menasha, Wis., 1950.

The following is based on the author's introduction and summary. Changes in soil fertility often alter the susceptibility of crops to insect attack. Preliminary observations on field maize in the lower Yakima Valley of Washington in 1947 indicated that maize grown on previously uncropped soil fertilised with 240 lb. nitrogen per acre was less infested and less severely damaged by *Heliothis armigera* (Hb.) than maize grown without nitrogen fertiliser, the infestation of the ears decreasing from 100 per cent. on the unfertilised plots to 86 per cent. on fertilised plots and the mean number of injured seeds in a sample of 500 from 108 to 20. Observations were continued in 1948 at the Irrigation Experiment Station, Prosser, in connection with a study of the effects of winter leguminous cover crops, manure, nitrogen supply and plant spacing on the yields and quality of sweet maize on newly irrigated land. Analysis of the results showed highly significant differences in injury by *Heliothis* between plots receiving various amounts of nitrogen and different winter pretreatments. There was no significant difference in injury on plants spaced six and nine inches apart. Increasing the nitrogen in the soil induced earlier silking and maturity ; increased the number and size of ears and reduced the number of barren stalks ; and increased the length of husk extension and the tightness of husks. The lower moth populations at the earlier dates of silking resulted in lower infestations, and the larger size of the ears resulted in less kernel consumption by a given population of larvae. Differences in the actual nutritive value of the maize were of secondary importance. Although the reduction in infestation and damage was not sufficient to indicate that increase of soil fertility would serve as a practical control measure against *Heliothis*, the degree of control is an additional inducement to maintain high soil fertility.

KULASH (W. M.). **Further Tests for Earworm Control in Sweet Corn.**—*J. econ. Ent.* **43** no. 4 pp. 430–432, 2 refs. Menasha, Wis., 1950.

In further tests made early in 1949 on the control of *Heliothis armigera* (Hb.) on sweet maize in North Carolina [*cf.* *R.A.E.*, A **37** 420], five insecticides were applied to two plantings at the rate of approximately 1–2 lb. per acre in sprays and dusts. Sprays containing 10 ml. 25 per cent. emulsion concentrates of DDD (dichlorodiphenyldichloroethane), 2-nitro-1,1-bis (parachlorophenyl) propane, 2-nitro-1,1–bis (parachlorophenyl) butane or DDT per litre water or 10 ml. 42 per cent. toxaphene emulsion concentrate per 1·68 litre water increased the percentages of uninfested ears from 52·1 to 87·7, 82, 78·3, 74·8 and 67·6 in the first planting and from 56·9 to 82, 85·7, 75·9, 83·3 and 70·8 in the second.

Dusts containing 10 per cent. toxaphene and 5 per cent. DDD, DDT, 2-nitro-1,1 bis (parachlorophenyl) propane and 2-nitro-1,1-bis (parachlorophenyl) butane increased it to 93·6, 91·2, 89·4, 76 and 65·2 in the first planting and to 69·8, 74·3, 87·7, 65·9 and 79·4 in the second. Sprays and dusts were applied directly to the silk channel of the ear, sprays as a solid stream for 2–3 seconds per ear or long enough to wet the silk thoroughly, and dusts at about 20 lb. per acre. The first planting was sown on 15th April, treated five times at three-day intervals from 20th June and picked on 3rd–9th July. The second was sown on 7th May, treated five times at three-day intervals from 30th June and picked on 14th–21st July.

Statistical analysis of the results showed no significant difference between methods of application or time of planting ; adding a commercial adhesive to the sprays generally resulted in more heavily infested ears, but the differences were not significant. No change of flavour that could be ascribed to any of the treatments was detected. On the basis of all tests considered together, DDT and DDD were equally effective, and 2-nitro-1,1-bis (parachlorophenyl) propane, toxaphene and 2-nitro-1,1-bis (parachlorophenyl) butane were progressively less efficient. All treatments were significantly better than none.

CUTKOMP (L. K.) & HOLDAWAY (F. G.). **Small Scale Field Evaluation of Insecticides for Corn Borer Control.**—*J. econ. Ent.* **43** no. 4 pp. 433–438, 4 refs. Menasha, Wis., 1950.

The authors describe a small-scale field method of evaluating insecticides for the control of *Pyrausta nubilalis* (Hb.) on maize, in which single plants are infested by hand with sufficient laboratory-produced egg masses, just about to hatch, to produce the required infestation at any stage of plant development. They also give preliminary results obtained by this method.

Immediate toxicity was tested by applying the insecticides 48 hours after the plants were infested and residual toxicity by applying them 1–3 days before infestation. Sprays were used, and the quantities of insecticides given are for 100 U.S. gals. water. In tests of immediate toxicity, 1 lb. heptachlor [1(or 3a),4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-4,7-endomethanoindene] as a wettable powder, 0·5 lb. dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene) or parathion as emulsions or a mixture of 0·15 lb. parathion and 1 lb. DDT in emulsion gave 76–79 per cent. reduction in injury ; 0·75 lb. aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-diendomethanonaphthalene], 0·3 lb. parathion or 1 lb. fluoro-DDT (DFDT) in emulsion, 0·4 lb. TEPP (tetraethyl pyrophosphate) in solution or 1·25 lb. fluoro-DDT as a wettable powder gave 64–70 per cent. reduction ; and 0·75 lb. EPN (stated to be ethyl paranitrophenyl thiophosphonate [but *cf. R.A.E.*, A **39** 12] as a 31·5 per cent. wettable powder) or 1 lb. DDT (90 per cent.) as a wettable powder gave 57 and 54 per cent. Comparison of sprays containing dieldrin, fluoro-DDT, parathion, DDD (dichlorodiphenyldichloroethane) or DDT prepared from emulsions and wettable powders showed that the emulsions of the first two were significantly more effective in immediate kill than the wettable powder sprays, and there was a definite trend in the same direction with all materials but DDT.

In tests of residual action, 0·75 lb. EPN, or 1 lb. heptachlor or fluoro-DDT as wettable powders or 0·75 lb. aldrin in emulsion gave 73–79 per cent. reduction in injury ; 0·5 lb. 2-nitro-1,1-bis (parachlorophenyl) propane or 2-nitro-1,1-bis (parachlorophenyl) butane as emulsions, 0·5 lb. dieldrin and 1 lb. DDT (90 per cent.) as wettable powders and the mixture of parathion and DDT gave 39–56 per cent. ; and 0·25 lb. rotenone or dihydrorotenone, 0·5 lb. parathion, 1 lb. DDT (75 per cent.), 1·25 lb. DDD or methyl-DDT (tolyl analogue of DDT) and 6 lb. Ryania as wettable powders, and 0·5 lb. parathion or dieldrin or 3 lb.

methoxy-DDT (methoxychlor) in emulsions gave less than 20 per cent. TEPP had no residual effect, and the plants treated with it were more injured than untreated ones. Comparison of different formulations of fluoro-DDT, dieldrin, DDT, DDD and parathion showed that wettable powders tend to be more effective than emulsions, except in the case of parathion ; the difference was statistically significant for fluoro-DDT.

The figures for reduction of injury by the insecticides are based on the combined results for two varieties of maize, of which Golden Cross Bantam sustained much more injury than Minnesota Valley Hybrid, but the effectiveness of certain insecticides differed on the two varieties. Chrysopid larvae made proper evaluation of the results more difficult by destroying young larvae and eggs of *Pyrausta*. One method of minimising the effect of predators and parasites appears to be to use TEPP, which is highly toxic, but deteriorates rapidly, to reduce or eliminate populations of insects undesirable for the study 24 or 48 hours before the introduction of the artificial infestation.

GYRISCO (G. G.) & MARSHALL (D. S.). **The Control of Insects of Alfalfa and Red Clover in New York.**—*J. econ. Ent.* **43** no. 4 pp. 438–443. Menasha, Wis., 1950.

The following is based on the authors' summary. Several preliminary field tests of dusts against insects attacking lucerne and red clover were carried out during 1948 in Oswego and Cayuga Counties in New York. It was found that *Sitona flavescens* (Marsh.) and *Tychius* spp. could be effectively controlled by 1 per cent. parathion applied at the rate of about 45 lb. per acre. Excellent control of grasshoppers for 20 days was obtained with 5 per cent. chlordan, 1 per cent. parathion or 3–6 per cent. γ BHC (benzene hexachloride). *Macrosiphum onobrychis* Boy. (*pisi* Kalt.) and other Aphids were significantly reduced for two weeks by 1 per cent. parathion, 6 per cent. γ BHC or 5 per cent. DDT. Although adult Cercopids, largely *Philaenus leucophthalmus* (L.) and *P. lineatus* (L.), were difficult to control, 6 per cent. γ BHC, 1 per cent. parathion and 5 per cent. chlordan all showed some promise for immediate kills. None showed any lasting toxicity, and the populations of the treated plots quickly increased to equal those of untreated ones. Dusts containing 5 per cent. DDT, 3–5 per cent. DDD(dichlorodiphenyldichloroethane), 1 per cent. parathion, 3–6 per cent. γBHC and 5 per cent. chlordan usually gave good reductions of *Lygus oblineatus* (Say) and other species of *Lygus*, but their toxicity did not persist for more than a week. Dusts containing piperonyl cyclonene and pyrethrins, with or without rotenone, gave some control of Aphids and grasshoppers, but were not satisfactory for use on forage crops ; both showed little lasting toxicity.

Many other species of insects were present in the experimental plots, but their numbers were too small to yield significant results.

MICHELBACHER (A. E.) & MIDDLEKAUFF (W. W.). **Control of the Melon Aphid in northern California.**—*J. econ. Ent.* **43** no. 4 pp. 444–447. Menasha, Wis., 1950.

Aphis gossypii Glov. was very abundant and widespread on many kinds of melons in California in 1949, and several insecticidal dusts were applied to many varieties at the rate of 30–35 lb. per acre for its control. In very limited tests, dusts containing 2·5 per cent. aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-diendomethanonaphthalene] or dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene] showed some promise, with some evidence of residual action. Of the three insecticides tested extensively under conditions of severe infestation, 2 per cent. parathion gave the highest initial kill, followed by 1 per cent. TEPP (tetraethyl pyrophosphate) and then 4 per cent. nicotine, but the best treatments rarely remained effective for more than three weeks.

When applied under satisfactory conditions, TEPP and parathion resulted in almost complete initial kill, but this was frequently nullified by a heavy influx of winged Aphids from adjacent severely infested melon fields. Both these insecticides affected predators, particularly Coccinellids, adversely, whereas nicotine had much less effect. Where the predator population was reduced to an extremely low level, even the best treatments failed to give control for long, owing to the constant influx of migrating Aphids, which easily established new colonies, so that the population increased extremely rapidly. It appears that satisfactory control of *A. gossypii* cannot be obtained where infestation is severe and there are few natural enemies.

The serious problem created by migrating Aphids cannot be effectively met by individual farmers, but some evidence indicated that considerable benefit might be derived through community action. The control secured in a particular field was greatly improved when treatment was delayed until adjacent fields in which harvest was just completed were disked under, as this eliminated an important source of migrating Aphids. Where it was impossible to destroy heavily infested fields, it was better to treat the fields to the windward first. The Aphids were more easily reached by the dusts when plant growth was sparse and on calm still days, though parathion could be applied over a wider range of weather conditions than TEPP, which gave poor Aphid control but a normal kill of predators when applied to plants wet with dew. Only products in which little deterioration of TEPP occurs for several weeks after they are prepared should be used.

Although applications of DDT to melons have frequently caused an increase in Aphid populations, they are desirable for the control of *Diabrotica undecimpunctata* Mannh., *Acalymma* (*D.*) *trivittata* (Mannh.) and *Empoasca abrupta* DeL., which are very destructive to melons. In 1948 and 1949, it was found that DDT could be applied under some conditions without causing severe Aphid injury. The amount used should be kept to a minimum, and treatments should be properly and thoroughly applied so that both beetles and the leafhopper are nearly eliminated from the fields. An insecticide such as cryolite should be used against the beetles during the early stages of growth and an application of DDT later, when the leafhopper population justifies control. It was found that 30 lb. 3 per cent. DDT dust or a spray applied at the rate of about 2 lb. 50 per cent. wettable powder per acre gave adequate control without serious dislocation of the environmental balance. During 1949, such treatment was followed by a threatening increase in the Aphid population, but the threat failed to develop because of the rapid rise in the predator population, and almost perfect biological control was finally obtained. Although the predators increase rapidly under favourable conditions, they disperse rapidly when the Aphid is controlled, and when it is evident that natural enemies are in a position to control the Aphid, applications of insecticides that are likely to destroy the balance should be avoided if this is at all possible.

MICHELBACHER (A. E.), MIDDLEKAUFF (W. W.) & WEGENEK (E.). **The Walnut Aphid in northern California.**—*J. econ. Ent.* **43** no. 4 pp. 448–456, 1 graph, 4 refs. Menasha, Wis., 1950.

The following is based on the authors' summary. *Chromaphis juglandicola* (Kalt.) is one of the most destructive insects attacking walnut in northern California, where it occurs in large numbers each year. It would be much more troublesome if it were not attacked by many natural enemies, of which predators appear to be the most important and keep it in check under natural conditions. Despite this, there is a tendency for the Aphid population to reach a dangerous level, and control measures are justified. Aphicides should be applied when they will have the least adverse effect on the balance between pest and predator, which is most likely to be when the Aphids average about 10 per leaflet and are increasing. Usually the predator population is very low and the Aphid population about to expand rapidly at this point. If the application is delayed until the Aphid population reaches a high level, there is every likelihood that the natural enemies will be increasing at a rate that will soon reduce the population and that the insecticide may do more harm than good.

Investigations showed that the insecticides used against the codling moth [*Cydia pomonella* (L.)] on walnut tend to increase the Aphid problem, and when DDT is used in the spray programme it should be in combination with an aphicide. On the Payne variety of walnuts, a spray against the moth is usually desirable during the first half of May, and three years' results indicated that the addition of an aphicide to this spray controls *Chromaphis* when insecticides appear to have the least adverse effect on the balance between Aphid and predator. It also makes the application of spring irrigation possible without the development of a destructive Aphid population while the orchard is under water. The addition of 1 lb. 14 per cent. nicotine dry concentrate, 0·67 lb. crude BHC (benzene hexachloride containing 10 per cent. γ isomer), 0·33 lb. 25 per cent. parathion wettable powder or 0·25 U.S. pints 20 per cent. TEPP (tetraethyl pyrophosphate) per 100 U.S. gals. spray all resulted in excellent control of the Aphid when the sprays were thoroughly applied, and no serious objections to the use of any of these aphicides was encountered. BHC is the cheapest but may affect the flavour of the walnuts. Such an effect was not observed in these tests, but was noticed by growers using BHC in two sprays or later in the season. Investigations are needed to determine whether there is any danger that BHC may accumulate in the soil over a period of years and so affect nut flavour ; if the use of crude BHC should be limited for this reason, it is possible that lindane [at least 99 per cent. γ BHC] can be used in its place, but this would add considerably to the cost. Information obtained during 1949 indicated that parathion should prove effective at a much lower concentration than that given above. At present it appears that the nicotine dry concentrate offers the least hazard as an aphicide. This insecticide gives good control when properly applied with either a conventional sprayer or speed-sprayer, and it is known to have the least adverse effect on wild life as well as on the natural enemies of the Aphid. The aphicides appeared to be more effective when used with DDT than with standard lead arsenate.

At mid-season or late in the season, sprays containing 2 lb. 25 per cent. wettable parathion powder, 1 U.S. pint 40 per cent. TEPP or 12 lb. 14 per cent. nicotine dry concentrate per 100 U.S. gals., applied at 50 U.S. gals. per acre with an air-blast sprayer gave very good results. Parathion was most effective. TEPP was very satisfactory, in spite of the low dosage, but when the rate of application dropped much below 50 U.S. gals. per acre, some Aphids escaped ; as it is difficult to maintain a constant application of 50 U.S. gals. per acre, it is probable that the concentration of TEPP should be increased by a third. The nicotine treatment did not give such good initial kill, but permitted the survival of many predators, which made the final control at least equal to that obtained with TEPP. At the dosage used in these applications, both parathion and TEPP are very destructive to natural enemies, and an exceptionally good kill of the Aphid is therefore needed to avoid the risk of a serious and rapid increase in population. Where Aphid control is nearly complete, predators will usually re-establish themselves by the time the Aphid population begins to increase rapidly and will control the infestation before it is injurious, provided that artificial control is not applied again. Further investigations on the effect of applications of parathion and TEPP, made with an air-blast sprayer, on predators and parasites, wild life in general, plants and other pests are needed before they are used freely on a commercial scale.

Exceptionally good control of the Aphid was obtained where TEPP was applied as an aerosol, but this method is considered too hazardous for general use, as there is no way of controlling drift.

Because of the extreme toxicity of TEPP and parathion to man, they should be used and handled with care, the precautions suggested by the manufacturer being carefully followed.

GAMBRELL (F. L.) & YOUNG jr. (H. C.). **Habits, Rates of Infestation and Control of Woolly Apple Aphid in Nursery Plantings.**—*J. econ. Ent.* **43** no. 4 pp. 463–465, 2 refs. Menasha, Wis., 1950.

The following is based on the authors' summary. *Eriosoma lanigerum* (Hsm.) is a serious pest of apple seedlings, East Malling rootstocks and budded varieties in nurseries in western New York. Loss at digging time may approach or even exceed 50 per cent. of the two-year-old apple trees. The varieties Red Spy and Northern Spy are much less susceptible to infestation than Baldwin, R. I. Greening, Cortland, Roger's McIntosh, Early McIntosh and Double Red Delicious, but the roots of the seedlings on which the Spy varieties are budded may be as heavily infested as any other variety, so that unless they are grown on their own roots, the loss of Red and Northern Spy apples through unsaleable trees may be as high as that of other varieties.

A spray of 2 lb. BHC (benzene hexachloride containing 12 per cent. γ isomer) and 1 U.S. pint liquid oil-based adhesive (Orthex) per 100 U.S. gals. showed considerable promise for the control of this Aphid when applied six times at intervals of two weeks from 27th May. Sprays containing 1 lb. 25 per cent. parathion or 1 U.S. quart nicotine sulphate per 100 U.S. gals. were somewhat less effective when applied under similar conditions. The effect of DDT in the nursery spray programme on *Aphelinus mali* (Hald.), the parasite of *E. lanigerum*, was not ascertained, but whether DDT is used or not, BHC should be applied to seedlings and apple trees one and two years old for the control of the Aphid.

RICHARDSON (C. H.) & DU CHANOIS (F. R.). **Codling Moth Infestation of the Tops of Apple Trees.**—*J. econ. Ent.* **43** no. 4 pp. 466–470, 12 refs. Menasha, Wis., 1950.

The following is almost entirely based on the authors' summary. During experiments on the control of the codling moth [*Cydia pomonella* (L.)] in two Iowa apple orchards sprayed with DDT during 1949, it was observed that the amount of damage on apples at the extreme tops of the trees was about 2–6 times as great as on apples less than six feet from the ground, and the same condition probably prevailed during the entire season. There is some evidence in the literature that greater infestation in the higher parts of apple trees is due to a preference of the moth for the tops of the trees as a site for oviposition and more evidence that it is due to faulty spray coverage or imperfect maintenance of spray deposit. This evidence applies to apple trees sprayed with lead arsenate, DDT and probably other insecticides that deteriorate by weathering or are not strongly ovicidal or repellent to the moths ; to the entire season of normal activity of *C. pomonella* ; to trees 10–12 ft. or more in height ; to the upper half of the tree, though it is most striking at the extreme top ; and to all apple-growing regions of the United States. Heavy top infestations are often overlooked because the fruit from the tops is not segregated when infestation records are made. Excessive top infestations act as foci from which the moths may spread the infestation over the orchard and may prove to be more important than the population of overwintering larvae in determining the size of a season's infestation.

Control of top infestations is briefly discussed and it is concluded that more information, based on studies of actual top infestations, is required on the value of removing high sparse tree growth, opening up the trees, lowering the tops within effective reach of sprays, and removing fruit from the tops, and also on the effect of new spraying equipment and new insecticides.

EDWARDS jr. (F. I.) & SMITH (F. F.). **Plant Injury from Parathion and related Compounds.**—*J. econ. Ent.* **43** no. 4 pp. 471–473, 1 ref. Menasha, Wis., 1950.

Several cases of injury to plants by technical-grade parathion have been reported, and investigations were made to determine the injurious agents. Three varieties of tomatos and *Crassula multicava* were used as test plants. In addition to pure parathion [O,O-diethyl O-paranitrophenyl thiophosphate] and technical parathions, the compounds investigated were O-ethyl O,O-bis(paranitrophenyl) thiophosphate, paranitrophenol, orthonitrophenol and triethyl thiophosphate, which are possible impurities in technical parathion, O,O-diethyl O-paranitrophenyl phosphate (the oxygen analogue of parathion) and O,O-dimethyl O-paranitrophenyl thiophosphate (the methyl homologue). They were ground with pyrophyllite and made into sprays with water containing a little decylbenzene sodium sulphonate ; the sprays were applied to plants growing in the greenhouse until they were completely covered but there was no run-off.

Tomato plants treated with some technical parathions at 2 lb. per 100 U.S. gals. suffered an immediate marginal bleaching and a delayed necrotic spotting throughout the entire leaf surface. When pure parathion, pure paranitrophenol, mixtures of the two containing 2, 5 and 10 per cent. paranitrophenol and pure orthonitrophenol were compared, the main injury to tomatos was marginal bleaching and was directly related to the amount of free paranitrophenol present. Pure paranitrophenol did not injure *Crassula* and orthonitrophenol did not injure either tomatos or *Crassula*. Neither O-ethyl O,O-bis (paranitrophenyl) thiophosphate nor triethyl thiophosphate injured tomatos at concentrations of 2 lb. per 100 U.S. gals. or less ; the former did not injure *Crassula*, but the latter caused severe necrosis and death of the plants at the 2 lb. dosage and moderate necrosis at lower dosages, though it was very much less injurious than parathion. O,O-diethyl O-paranitrophenyl phosphate caused immediate marginal bleaching of tomato and severely injured *Crassula*, and O,O-dimethyl O-paranitrophenyl thiophosphate caused similar but less severe injury.

It is concluded that the immediate marginal bleaching of tomato plants may be caused by paranitrophenol, O,O-diethyl O-paranitrophenyl thiophosphate or O,O-dimethyl O-paranitrophenyl thiophosphate and the delayed general necrotic spotting by parathion. The concentrations used in insect control rarely exceed 0·5 lb. parathion per 100 U.S. gals., at which level injury was very slight. The injury and death of *Crassula* may be caused by parathion, its oxygen analogue or its methyl homologue. At comparable doses of the pure compounds, parathion was less toxic and its oxygen analogue more toxic to tomatos than its methyl homologue, whereas the oxygen analogue was more toxic and the methyl homologue less toxic than parathion to *Crassula*. In a series of technical parathions that were tested, the content of paranitrophenol, the impurity largely responsible for injury to tomato, varied from 0·3 to 10·8 per cent. The majority of the samples contained 1·8 per cent. or less and did not cause the characteristic bleaching injury that followed similar applications of the less refined samples.

DRIGGERS (B. F.). **Effect of Parathion on immature Stages of Plum Curculio, Oriental Fruit Moth and Codling Moth within the Host Plant.**—*J. econ. Ent.* **43** no. 4 pp. 474–476. Menasha, Wis., 1950.

The following is almost entirely based on the author's summary. Observations and experiments were carried out in 1949 in orchards in New Jersey to determine the effect of parathion on recently hatched larvae of the plum curculio [*Conotrachelus nenuphar* (Hbst.)] in immature peach fruits, the oriental fruit moth [*Cydia molesta* (Busck)] in peach twigs and the codling moth [*C. pomonella* (L.)] in apple fruit. Parathion was used under orchard conditions at 1 lb. 25 per cent. wettable powder and 1·5 lb. 15 per cent. wettable powder per 100 U.S. gals. water. By dissection and rearing it was determined that the parathion killed large proportions of the recently entered larvae of the three species, but whether it did so by fumigation, by entering the galleries or by absorption through the plant tissues was not determined. Analyses of apples ten days after the spray was applied showed 0·1 parts per million or less of parathion residue.

MUMA (M. H.), LYNESS (R. N.), CLAASSEN (C. E.) & HOFFMAN (A.). **Control Tests on Sunflower Insects in Nebraska.**—*J. econ. Ent.* **43** no. 4 pp. 477–480, 5 refs. Menasha, Wis., 1950.

Many varieties and inbred lines of sunflowers (*Helianthus annuus*) have been grown in observation plots in several parts of Nebraska since 1942, but failures, due usually to insect damage, have been frequent and investigations on possible control measures were carried out in 1948 and 1949.

In 1948, dusts containing 1 and 5 per cent. γ BHC (benzene hexachloride) and 5 and 10 per cent. DDT were applied to the flower heads at 0·2 and 1 lb. γ BHC and 1 and 2 lb. DDT per acre on 10th July, and in 1949, sprays prepared from BHC wettable powder were applied to the soil at 2 lb. γ isomer per acre or to the foliage before flowering or into the open heads after flowering at 0·5 lb. γ isomer per acre. The plants were sown on 2nd May and 8th June and soil applications made on 29th April and 1st June, respectively, prebloom sprays on 3rd June and 8th July and postbloom sprays on 28th July and 6th August.

Treatment of the sunflower heads with the stronger BHC dust or the spray significantly reduced populations of *Desmoris constrictus* (Say) and *D. fulvus* (Lec.) for five days, but not the percentage of infested seed ; it is possible that applications earlier in the blooming season would be more effective. DDT showed no promise.

In 1949, untreated plots sown on 2nd May, which had fully matured by harvest time on 21st September, averaged less than one larva of *Homoeosoma electellum* (Hulst) per head at harvest, whereas untreated plots sown on 8th June averaged nearly three per head and were still too succulent to harvest ; yields and oil percentages of the seed were also significantly higher in the early planting. In 1948, differences in larval population between treated and untreated plots were not significant, but in 1949, post-bloom sprays of BHC gave the best control in the earlier planting and all treatments seemed to have some effect in the late one ; applications of BHC early in the blooming period are suggested. DDT did not seem to affect *H. electellum.*

The BHC dust caused a striking reduction in injurious populations of *Diacrisia virginica* (F.) and *Estigmene acraea* (Dru.), which developed in 1948, and DDT an equally striking increase, presumably because of the elimination of natural enemies. Moderate to severe leaf injury occurred on all plots but those receiving 1 lb. γ BHC per acre, and this injury caused reductions in yield.

Several stem-borers, identified as *Hippopsis lemniscata* (F.) and species of *Ataxia* and *Mordellistena,* infested about half the flower stems in 1948 and nearly all of them in 1949. The stronger BHC dust caused a significant reduction in numbers of infested plants, but no other treatment gave significant control.

Howe (W. L.). **Biology and Host Relationships of the Squash Vine Borer.**—*J. econ. Ent.* **43** no. 4 pp. 480–483, 16 refs. Menasha, Wis., 1950.

The results are given of investigations in New York on the feeding of *Melittia cucurbitae* (Harr.) on cultivated cucurbits of genera that have been introduced comparatively recently into its normal range of food-plants. Eggs of the moth were put either on small cubes of squash-fruit rind, which were introduced into niches cut in segments of squash after the larvae had hatched and bored into them, or on short stem sections, which were put in larger stem sections or the stems of growing plants after the second instar was reached. When the larvae were mature, they left the fruit and pupated normally in soil. No adult emergence occurred until the following spring or summer, though field collection of cast pupal skins indicated that a partial second generation occurred in 1949 in northern New York.

Attempts were made to rear the larvae in the stalks or fruit of watermelon (*Citrullus vulgaris*), cucumber (*Cucumis sativus*) and cantaloupe melon (*C. melo*), which are of African and Asiatic origin and were first reported in America late in the fifteenth century. These plants have often been recorded as important food-plants of the borer, especially in the older literature, but the tough woody nature of their stems would appear to make them unsuitable. None of the newly hatched larvae introduced into the stems or fruits of these cultivated cucurbits was able to use the tissues for continued development. Although most larvae entered the tissues, development was retarded, colour was abnormal and death usually resulted before the second instar was reached.

Peterson (A. G.) & Granovsky (A. A.). **Relation of** ***Empoasca fabae*** **to Hopperburn and Yields of Potatoes.**—*J. econ. Ent.* **43** no. 4 pp. 484–487, 3 graphs, 18 refs. Menasha, Wis., 1950.

In an experiment in Minnesota designed to provide quantitative information on the degree of hopperburn and extent of yield reduction resulting from infestation of potato by different populations of *Empoasca fabae* (Harr.), 25, 50, 100, 200 or 300 leafhopper nymphs were introduced on 8th July 1948 into cages containing two potato plants grown from tubers set on 11th May. A generation was completed by the middle of August ; some plants had 40 per cent. hopperburn by 17th August and the more heavily infested were dead by 30th August. In 1949, the tubers were planted on 10th May, 0–300 adults were introduced on 9th July, and nymphs were abundant and hopperburn fairly extensive in some cages by 30th July. During August, the increased prevalence of tipburn due to the weather and of early blight made estimations of hopperburn difficult, but some plants were dead by 18th August. Periodical observations of numbers of leafhoppers and percentage hopperburn were made each year. The number of nymphs per 10 leaves was correlated with the percentage hopperburn in August 1948 and July 1949. Yields were negatively correlated with numbers of nymphs in both years ; the relations of yield to nymph density and percentage hopperburn were both expressed by logarithmic curves. Relatively great yield reductions resulted from low leafhopper densities, and with further increases in population the yield reductions became proportionally less. The injury appeared to have little if any adverse effect on the subsequent yielding ability of tubers from affected plants.

DUNNAM (E. W.) & CALHOUN (S. L.). **Artificial Defoliation of Cotton and Boll Weevil Control.**—*J. econ. Ent.* **43** no. 4 pp. 488–490, 4 refs. Menasha, Wis., 1950.

The following is based on the authors' summary. Investigations on the response of adults of *Anthonomus grandis* Boh. to the defoliation of cotton by dusting it with calcium cyanamide and on the value of this practice in controlling the weevil [*cf. R.A.E.*, A **34** 178, etc.] were carried out at Stoneville, Mississippi, in 1942–46. It was found that defoliation caused an almost immediate exodus of weevils to untreated fields, and when cotton was treated as early as 23rd August, the insect did not mature on any second growth before frosts began on 1st November. The removal of leaves, squares and young bolls artificially checked plant growth, accelerated the opening of the bolls and made an earlier harvest possible, and under these conditions, cotton stalks could be destroyed earlier in the season, offering a supplement to the regular campaign of destroying cotton stalks for weevil control.

Defoliation is practised extensively in the Mississippi Delta as an aid to mechanical harvesting, but it is doubtless very beneficial for boll weevil control.

CHAPMAN (A. J.), FIFE (L. C.), SMITH (G. L.) & CLARK (J. C.). **DDT for Control of the Pink Bollworm in Mexico in 1946.**—*J. econ. Ent.* **43** no. 4 pp. 491–494. Menasha, Wis., 1950.

The following is mainly from the authors' summary. Investigations on the value of DDT for the control of *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) on cotton were carried out in the Laguna District of Mexico during the summer of 1946.

In large-scale tests, an average of 6·4 applications of 10 per cent. DDT dust, made at weekly intervals at the average rate of 16·3 lb. per acre, gave 58 per cent. reduction in bollworm population on 278 acres of cotton. The infestation in the dusted cotton increased rapidly after 15th August, but the increase was not so rapid as in the untreated plots. Dusted fields produced an average of 259 lb. (14 per cent.) more seed cotton per acre than untreated ones. There was no difference in the grade and staple or in the oil or protein content of the seed in samples from dusted and untreated plots. Increasing the quantity of DDT dust applied from 1 to 3 lb. per acre per application increased control, regardless of the concentration of the mixture.

When the results for the dusted plots were grouped according to the amount of technical DDT applied per acre for the season, the control averaged 52, 62 and 73 per cent. for total dosages of about 7, 12 and 17 lb. DDT per acre. Thus, approximately 10 per cent. increase in control resulted from every additional 5 lb. technical DDT applied.

Weekly applications of DDT as a dust and in emulsified solution as a spray gave about the same control. Fortnightly applications of 3·1 lb. per acre as a dust or 3·5 lb. as a spray were nearly as effective as weekly applications of 1·83 lb. as a dust or 1·82 lb. as a spray, respectively, but both of the spray treatments were significantly more effective than the fortnightly applications of dust.

PRITCHARD (A. E.) & BEER (R. E.). **Biology and Control of *Asterolecanium* Scales on Oaks in California.**—*J. econ. Ent.* **43** no. 4 pp. 494–497, 8 refs. Menasha, Wis., 1950.

The following is substantially the authors' summary. *Asterolecanium minus* Ldgr. is the most abundant pit scale on oaks in northern California, *A. quercicola* (Bch.) is commonly found, and *A. variolosum* (Ratz.) seldom encountered. The scales cause serious damage to oaks, especially the valley oak (*Quercus* *lobata*) and the blue oak (*Q. douglasii*) among native trees. Crawlers of *A. minus* and *A. quercicola* are produced from early May to late September in the San Francisco Bay area, the peak occurring within two or three weeks of the first emergence.

In tests of sprays against *A. minus*, a February application of a 5 per cent. emulsion-type dormant oil, with or without the addition of DDT or toxaphene, gave a very high kill of the overwintering females, but numerous progeny were found on the new growth during the following summer, and a repellent action of the dormant oil on older wood was indicated. Application on 21st May or 27th July of a 2 per cent. light-medium foliage oil with 1·5 lb. actual toxaphene (formulated as an emulsion) gave excellent control, the results indicating that all stages of the scale were killed. Toxaphene alone and a 2 per cent. light-medium foliage oil containing 4·5 per cent. DDT both gave unsatisfactory control.

The combination of light-medium foliage oil and toxaphene also gave excellent control of common oak aphids (*Myzocallis* spp.), a species of *Paratetranychus* and larvae of *Phryganidia californica* Pack., which were abundant on untreated trees.

Rodriguez (J. G.) & Gould (W. A.). **Effect of Technical Benzene Hexachloride and Lindane on the Flavor of Tomatoes and Potatoes.**—*J. econ. Ent.* **43** no. 4 pp. 498–503, 6 refs. Menasha, Wis., 1950.

The following is substantially the authors' summary and conclusions. New formulations of technical BHC (benzene hexachloride) and lindane (containing over 99 per cent. γ BHC) were tested on tomatos and potatoes grown in acid and alkaline soils in the greenhouse in an effort to investigate the possibility of eliminating objectionable qualities. They were used in soil treatments at the rate of 2 lb. γ isomer per acre and also in supplementary spray treatments at the rate of 3 oz. γ isomer per 100 U.S. gals. water. Five sprays were applied to each crop, and residues accumulated heavily on the foliage.

A panel composed of 8–10 experienced judges tasted the treated products after they had been canned and stored for a short period. The panel judged the tomatos grown in acid soil (pH 5·3) as being no different from those grown in alkaline soil (pH 7·6). The soil pH (5·6 and 7·5) also had no influence on the flavour of potatoes. The tomatos treated with technical BHC were considered to taste musty, all treatments being significantly different from none. Potatoes treated with technical BHC were not musty, but were definitely affected in flavour and significantly different from untreated ones. Tomatos and potatoes treated with lindane were slightly affected, but were not generally significantly different from untreated ones.

Samples of the treated products were analysed for residues, and it was found that those treated with technical BHC had considerably more residue than those treated with lindane. There appeared to be a strong correlation between residue and flavour contamination, though the latter was more difficult to perceive in potatoes than in tomatos with the same residue. Although the dosages used would probably not be excessive in the field, the fact that they were used under greenhouse conditions made them so.

Ebeling (W.). **Rate of Penetration of Oxygen through Layers of Petroleum Oil.**—*J. econ. Ent.* **43** no. 4 pp. 503–505, 1 fig., 2 refs. Menasha, Wis., 1950.

A technique was devised for comparing the rates of penetration of oxygen through uniform layers of different petroleum oils, as having a possible relation to insecticidal effectiveness. A 500 ml. erlenmeyer flask containing 50 ml.

alkaline pyrogallol solution and 10 ml. petroleum oil forming a layer 1·4 mm. thick on its surface was fitted with a mercury manometer with a sliding millimetre scale, and sealed. The oxygen penetrating through the oil was absorbed by the reducing agent and the rate of penetration was determined by recording the progress of the column of mercury in the manometer at suitable intervals.

A preliminary test with 12 oils of widely different physical and chemical properties showed a general inverse relation of oxygen penetration to specific gravity ; the effect of percentage of unsulphonated residue and degree of paraffinicity could not be determined from the limited number of oils tested. No implication that oils more impervious to oxygen would be more effective insecticides is intended, as experiments reported in a previous paper [*R.A.E.*, A **34** 134] indicated that, at least within limits, the opposite may be true provided all other factors are constant.

MAYER (E. L.), MCGOVRAN (E. R.), TALLEY (F. B.) & WILLAMAN (J. J.). **Tests for Synergism between Nicotine and Phthalonitrile and between Nicotine and 2,3,4,5,6-Pentachloroanisole.**—*J. econ. Ent.* **43** no. 4 pp. 533–537, 1 fig., 15 refs. Menasha, Wis., 1950.

In experiments to determine the degree of synergism between nicotine and phthalonitrile or 2,3,4,5,6-pentachloroanisole, both of which are insecticidal by themselves, Lepidopterous and Coleopterous larvae were treated by infesting dusted foliage of their food-plants, *Heliothrips haemorrhoidalis* (Bch.) by confining it with a dusted *Citrus* leaf, and adults of *Drosophila* sp. by confining them with dusted filter paper and a few grains of granulated sugar. Nymphs of *Macrosiphum onobrychis* (Boy.) (*pisi* (Kalt.)) were dusted on the underside of bean leaves, and fourth-instar larvae of *Cirphis unipuncta* (Haw.) were fumigated in petri dishes in the presence of untreated food. Final mortality counts were made after two days for *M. onobrychis* and after three for all other insects.

The results for all tests are summarised in a table, and another gives the detailed figures for tests with phthalonitrile and *Plutella maculipennis* (Curt.), while dosage mortality curves for the toxicants separately and together illustrate the different patterns of synergism against some of the insects.

Nicotine and phthalonitrile showed definite synergism against *M. onobrychis*, *C. unipuncta*, *P. maculipennis* and *Phryganidia californica* Pack., doubtful or no synergism against *Gastrophysa cyanea* (Melsh.), *Phlyctaenia rubigalis* (Gn.) and *Drosophila*, and antagonism against the thrips. Nicotine and pentachloroanisole were tested only against *Plutella* and *Cirphis* and showed neither synergism nor antagonism.

A detailed method of calculating synergism and a short one that is described were both applied to four groups of data given in this paper and to five other groups, and the numerical values obtained confirmed the conclusions of synergism and antagonism in these cases.

Sprays containing 0·1 per cent. nicotine with 0·3 per cent. phthalonitrile or 0·15 per cent. pentachloroanisole caused no injury to the foliage of maize, cucumber, potato, cabbage or wax bean.

DE ONG (E. R.), PEER (K. C.) & FANCHER (L. W.). **A new Generator for producing dry Aerosols with organic Insecticides.**—*J. econ. Ent.* **43** no. 4 pp. 542–546, 5 figs., 1 ref. Menasha, Wis., 1950.

The authors describe and figure an aerosol generator of the thermal decomposition type that operates at a much lower temperature than those in which pyrotechnic mixtures are employed [*cf. R.A.E.*, A **37** 480 ; **38** 53]. The aerosol produced is termed " dry " to distinguish it from mechanically produced aerosols in which the insecticides are in auxiliary solvents. The generator contains the insecticides in powdered admixture with unspecified dispersing chemicals, and a chemical reaction of the latter, initiated by means of a starter strip of the friction match type, first softens the insecticides by heat and then propels them into the air by the evolution of steam and other inert gases. The reaction proceeds throughout the mass in an even manner, the temperature seldom exceeds 250°C., and the large volumes of steam protect the organic insecticides from decomposition as they are dispelled. A zone of live steam and hot gases carrying the insecticides directly over the outlet is followed by one in which the steam condenses into fine droplets of water and insecticide about 5 μ in diameter. Most of the water has evaporated after 30 minutes at ordinary humidities, and the aerosol particles then begin to agglomerate and attain a size of 10–50 μ. Deposition of these on surfaces is followed by the growth of crystals, which may reach a length of 200 μ in the case of DDT. These project from the surface, allowing maximum contact with the insects. In the initial stage of suspension, the aerosol penetrates readily into microscopic openings, but after a few minutes will not penetrate fabrics of medium fine weave, owing to the increase in particle size. The insecticide deposit is even on all surfaces, but highest on horizontal ones. Insecticidal compounds such as DDT, chlordan, certain thiocyanates, methoxy DDT (methoxychlor) and BHC (benzene hexachloride) can be dispersed by this method with negligible decomposition. Liquid insecticides can be dispersed in formulations containing about 10 per cent. by weight, about 15 per cent. solid organic compounds being also present if desired, and solid ones in formulations containing about 30 per cent. by weight. The employment of an aerosol generator of this type is restricted to confined spaces, but it has the advantages that a cardboard container can be used for it and it is easy to operate without continued attention. In addition to the experiments noticed below, its efficiency was demonstrated by tests on houseflies [*R.A.E.*, B **39** 62].

Various organic insecticides, including two proprietary thiocyanate preparations (Lethane 384 and Lethane A-70), were dispersed by this generator in 1,000 cu. ft. chambers containing 20–30 adults of *Tribolium confusum* Duv. and *Calandra* (*Sitophilus*) *oryzae* (L.), caged 32 inches above the floor. The generator was put on the floor in the middle of the chamber. The average temperature was 61°F., and the cages were moved to a ventilated room at about the same temperature after four hours. The periods in hours in which all the insects became moribund were 24 for 36 gm. DDT, 16 for 24 gm. DDT with 6 gm. chlordan, 48 for 9 gm. DDT with 2·7 gm. chlordan and 3·6 gm. Lethane 384, 24 for 15 gm. chlordan, 18 for 30 gm. Lethane 384, 10 for 3·2 gm. lindane [at least 99 per cent. γ BHC], 16 for 2·9 gm. lindane with 4·8 gm. Lethane A-70, 12 for 5 gm. chloroacetophenone with 20 gm. DDT, and 24 for 48·7 gm. β,β'-dichloroethyl ether with 11·2 gm. DDT ; all these insects subsequently died. Toxaphene and methoxy-DDT, used at 20 and 26 gm., respectively, caused 70 and 56 per cent. of the insects to appear moribund in 45 hours, but 100 and 90 per cent. recovered.

A badly infested railway grain waggon with considerable loose grain piled in corners and other débris scattered on the floor was papered round the doors as for fumigation, test cages containing 28 adults of *C. oryzae* were put on the floor and a 1 lb. dry aerosol generator containing 20 per cent. DDT and 5 per cent. chlordan was discharged. The doors were shut for 24 hours, after which 19 of the caged weevils were dead and nine moribund ; all were dead 24 hours later. Of insects collected from the débris, etc., the numbers dead 24 and 48 hours after the doors were opened were 37 and 48 of 68 *C. oryzae*, 104 and 114 of 118 *T. confusum*, and 12 and 13 of 13 *Oryzaephilus surinamensis* (L.) from débris on the floor, and 12 and 12 of 29 *C. oryzae*, 37 and 44 of 45 *T. confusum*, and 12 and 13 of 13 *O. surinamensis* from impacted grain in a hole in the wall.

Another grain waggon badly infested with *T. confusum* and *O. surinamensis* was papered round the doors, the walls and floors being pounded to dislodge impacted grain, and closed for 24 hours after discharge of a 1 lb. dry aerosol generator containing 18 per cent. DDT, 5 per cent. chlordan and 6 per cent. lindane. Despite the papering, bad leaking of the aerosol was observed, but visual inspection revealed no active beetles when the waggon was opened. The grain from the floor was collected and examined. Of 2,510 examples of *T. confusum* and 349 of *O. surinamensis* found in it, all were dead after 28 and four hours, respectively. This grain exhibited residual action on grain weevils and bean Bruchids [*Bruchus obtectus* Say] for six months when stored in the atmosphere at moderate temperatures.

The results indicate that this form of treatment may be used in some circumstances to replace fumigation with toxic gases. When rabbits and their food-supply were enclosed in a chamber and subjected to twice the recommended dosage of dry aerosol for ten days, no acute toxic effects were observed. Respiratory irritation occurred in two of the ten test animals on the eighth day, but disappeared on removal from the chamber. It is believed that the absence of auxiliary solvents contributes to lowered toxicity to warm-blooded animals. Laboratory workers exposed to numerous aerosols of DDT, methoxy-DDT, BHC, chlordan and Lethane 384 over a period of five years exhibited no acute or chronic toxic symptoms.

RUDE (C. S.). **Cotton injured by** *Nysius californicus*.—*J. econ. Ent.* **43** no. 4 pp. 548–549. Menasha, Wis., 1950.

The Lygaeid, *Nysius californicus* Stål, which had frequently been collected on cotton in Mexico and the United States but was not known to injure it, became very abundant in cotton fields in the Laguna district of northern Mexico about the middle of June, 1949. It was found to be puncturing the squares and small bolls and sucking the sap, and such squares and bolls were soon shed. All squares and young bolls in some of the heavily infested fields had been shed. The insects apparently migrated into the cotton fields, as they appeared in large numbers suddenly. They were easily controlled by one or two applications of 10 per cent. DDT dust, after which the plants soon began to set and hold squares. However, during the remainder of the season, the areas on the plants in which shedding was heavy could be observed as having little or no fruit.

HOWE (W. L.). **Reactions of the Squash Vine Borer to certain insecticidal Soil Treatments.**—*J. econ. Ent.* **43** no. 4 pp. 549–550. Menasha, Wis., 1950.

In 1948, squash plants growing in soil treated with BHC (benzene hexachloride) containing 12 per cent. γ isomer at the rate of 2 lb. γ isomer per acre showed negligible infestation by *Melittia cucurbitae* (Harr.), in spite of heavy oviposition, and examination of the plants revealed numerous dead first-instar larvae inside shallow feeding lesions and in the leaf stalks. The flavour of the mature fruits was affected, particularly when they were cooked in steam under pressure. On squash plants grown in the same soil in 1949, oviposition was moderate, mortality of larvae was observed and no infestation developed.

Controlled experiments were carried out in 1949 to ascertain whether lindane [at least 99 per cent. γ BHC], dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene], chlordan or parathion would have a similar effect. Squash plants forced in the greenhouse were set out in hills containing approximately three plants each on 8th–9th June, and 250 gm. fertiliser containing 0·25 or 0·5 gm. actual toxicant was worked into the soil in a ring, about 1 ft. in diameter, round the base of each hill. The dosages were small and limited in area so that only the less extensive root system of the young plants would be exposed and the greatly expanded root system present when the fruit was being set would draw nutriment largely from untreated soil. Oviposition was first observed on 1st July, and hatching began about a week later. Final counts of injury made on 3rd October showed that with the possible exception of dieldrin, only lindane killed the larvae, which died after a small amount of boring. A later treatment of other plants by applying 2 gm. lindane round the base of each hill in 2 U.S. gals. wettable-powder suspension gave complete mortality of larvae at all stages within five days.

Although small quantities of lindane in the soil round preferred food-plants resulted in high mortality of larvae and greatly reduced plant injury, its value as a control measure appears to be doubtful owing to the danger of causing unfavourable changes in fruit flavour, texture and shape.

GAMBRELL (F. L.) & STRICKLAND (L. F.). **Control of White Grubs in Nursery Plantings.**—*J. econ. Ent.* **43** no. 4 pp. 550–552, 4 refs. Menasha, Wis., 1950.

White grubs frequently cause serious losses of young conifers in nurseries, injury in New York occurring usually on the lighter or gravelly soils. *Lachnosterna* (*Phyllophaga*) *rugosa* (Melsh.) caused severe damage in western New York during 1944 and 1947, and *Macrodactylus subspinosus* (F.) was frequently associated with it. White grubs are not very injurious during the 2–4 years in which conifer seedlings and rooted cuttings are grown in shaded lath houses, but the root weevils, *Otiorrhynchus* (*Brachyrrhinus*) *ovatus* (L.) and *O.* (*B.*) *sulcatus* (F.), feed on the roots and bark of some species below ground level.

In experiments on the control of second- and third-instar larvae of *L. rugosa* and third-instar larvae of *M. subspinosus*, carried out in 1947–49, lead arsenate, chlordan, DDT and parathion were applied at rates of 500, 20, 50 and 15 lb. per acre and BHC (benzene hexachloride) at 5 lb. γ isomer per acre. In preliminary tests in the autumn of 1947, larvae of both species were put in soil among rooted cuttings, and the insecticides were applied to the soil surface in water. All showed promise against both species, and, except for possible slight retardation with BHC, did not cause any appreciable injury to conifers growing in greenhouse flats over a period of 18 months. These included several varieties of yew [*Taxus*], arbor vitae [*Thuja*] and juniper, as well as Canada hemlock [*Tsuga canadensis*] and Douglas fir [*Pseudotsuga taxifolia*].

In October 1948, the same insecticides in water were sprinkled on soil in greenhouse flats that had been infested with grubs and sown with grass seed 24 hours before, and the treated soil was kept at 45–60°F. for 16 weeks. All except DDT gave at least 97 per cent. control of *M. subspinosus* and at least 60 and 66 per cent. control of the second and third instars of *L. rugosa* when these were present. Lead arsenate and chlordan gave complete mortality of *M. subspinosus*. Ethylene dichloride emulsion, tested at 20 U.S. gals. active ingredient per acre, killed all larvae of both instars of *L. rugosa* and gave 98 per cent. control of *M. subspinosus*.

In October 1949, lead arsenate, DDT, BHC, chlordan and parathion were intimately mixed with soil that was then put into boxes and infested with *Lachnosterna* larvae ; grass seed was mixed with the surface layer of soil at the beginning of the experiment and after each examination, to serve as food for the grubs. At temperatures of 50–60°F., chlordan, BHC, parathion and DDT gave complete kills 4, 5, 6 and 13 weeks, respectively, after treatment and there was 37 per cent. mortality in untreated soil and 48 per cent. in soil treated with lead arsenate after 13 weeks. At temperatures of 40–50°F., chlordan, BHC, parathion and DDT gave complete mortality 7, 8, 4 and 13 weeks after treatment.

Under nursery conditions, where a rapid kill of grubs is essential to protect young rooted cuttings and seedlings, BHC, chlordan and parathion show promise. They have not been tested under commercial conditions, and further experiments are needed to determine their residual action in the soil and their effect on the growth of a number of species and varieties of conifers.

NICKELS (C. B.). **Experiments in Control of the Pecan Weevil.**—*J. econ. Ent.* **43** no. 4 pp. 552–554, 1 ref. Menasha, Wis., 1950.

Tests of various insecticides in sprays against *Curculio caryae* (Horn) on pecan were carried out in central Texas in 1946–49. Lead arsenate had given considerable control in previous years [*cf.* *R.A.E.*, A **36** 151]. The quantities of spray ingredients given are per 100 U.S. gals., and the amounts of DDT and BHC (benzene hexachloride), of which wettable powders were used, are those of actual DDT and γ BHC, respectively.

In tests in which weevils were caged over treated branches on 12th September 1946, sprays containing 0·3 lb. γ BHC or 2·5 lb. DDT increased the percentage mortality of females from 28 to 94 and 100 and of males from 60 to 100 and 100, and reduced the numbers of feeding punctures from 283 to 66 and 30 and from 67 to 22 and 8, respectively.

In field tests, the sprays were timed by weevil emergence ; the weevils usually emerge from the soil in late August or September, unless the weather is dry, when most do not emerge until after rain begins. When injured nuts were observed, trees were jarred to determine whether enough weevils were present to justify spraying. Sprays were applied with a power machine, from the ground or the top of the sprayer tank, at a pressure of 500–600 lb. per sq. in. In 1946, applications of 0·3 lb. γ BHC on 2nd September and 0·2 lb. on 10th and 19th September or of 2·5 lb. DDT on all three dates were ineffective against an abnormally heavy infestation. In 1947, applications of 3 lb. DDT or 6 lb. lead arsenate, 6 lb. hydrated lime and 2 lb. zinc sulphate on 29th August and 9th and 20th September reduced the percentage of harvested nuts infested from 15 to 2 and 4, respectively. To control an Aphid of the genus *Myzocallis* (*Monellia*), which was abundant before the experiments began, TEPP (tetraethyl pyrophosphate) was included in the sprays on 29th August at the rate of 8 fl. oz. 11·2 per cent. TEPP with 2 U.S. quarts summer oil, but it was not very effective ; the addition of nicotine sulphate and oil at the same rates in the second spray gave better results. In another test, single applications of 1 U.S. quart 44 per cent. chlordan emulsion concentrate, 3 lb. DDT, 9 lb. 18·2 per cent. toxaphene wettable powder or 6 lb. lead arsenate on 4th September reduced the infestation of harvested nuts from 11 to 8, 2, 8 and 4, respectively. In 1948, application on 3rd and 13th September of 3 U.S. pints 74 per cent. chlordan emulsion, 3 lb. DDT with 2 lb. or 8 oz. 25 per cent. parathion wettable powder, or 3 lb. 25 per cent. parathion wettable powder reduced the infestation of harvested nuts from 20 to 3, 2, 0 and 2 per cent., respectively, and in 1949, single applications on 7th September of 3 lb. DDT, alone or with 3 lb. 15 per cent. parathion wettable powder, reduced it from 55 to 6 and 4 per cent., respectively. None of the spray mixtures caused any visible injury to the trees ; when used with lime and zinc sulphate, lead arsenate has seldom injured pecan foliage in a semi-arid climate.

GERSDORFF (W. A.) & MITLIN (N.). **Insecticidal Action of American Species of** *Heliopsis*.—*J. econ. Ent.* **43** no. 4 pp. 554–555, 3 refs. Menasha, Wis., 1950.

Air-dried plants of *Heliopsis scabra* from New Mexico, and *H. gracilis* and *H. parvifolia* from Texas, were divided into stems, roots, leaves and (in the case of the first two) flowers, and each part was finely ground and extracted for at least 18 hours in turn with petroleum ether (boiling point 30–40°C., Skellysolve A), ethyl ether and chloroform, and freed of solvent under reduced pressure. The extracts were incorporated with kerosene sprays at a concentration of 25 mg. per ml., acetone being used as auxiliary solvent where necessary. Pyrethrum standards of comparison were prepared from a concentrate in which Pyrethrum I and Cinerin I comprised 54 per cent. of the " total pyrethrins ". Sprays containing acetone were compared with standard sprays in which acetone had been incorporated at the same concentration. Tests were made on adults of *Musca domestica* L., and the results showed that these species of *Heliopsis* contained material about as toxic to the flies at 25 mg. per ml. as the pyrethrins at concentrations ranging from a little more than 2 to a little less than 1 mg. Practically all of it was extracted by petroleum ether. It was concentrated in the roots of all three species and in the flower heads of *H. gracilis*, but there was little in the flower heads of *H. scabra* ; moderate quantities were found in the stems of all three species and in the leaves of *H. scabra* and *H. parvifolia*, but not in the leaves of *H. gracilis*.

PORTER (J. E.) & HUGHES (J. H.). **Insect Eggs transported on the outer Surface of Airplanes.**—*J. econ. Ent.* **43** no. 4 pp. 555-557, 2 refs. Menasha, Wis., 1950.

Noctuid eggs (or in a few cases unidentified insect eggs) were found on the outside of 80 aeroplanes arriving at Miami, Florida, from the Caribbean area and South America ; two of them arrived in January 1943 and July 1946, respectively, and the others between 1st April and 31st December 1949. The eggs were found on the propellers, various parts of the fuselage, the under sides of the wings and the tail assembly and included viable eggs of *Laphygma frugiperda* (S. & A.), *L. exigua* (Hb.), *Prodenia dolichos* (F.) and *P. ornithogalli* Gn. The moths were apparently attracted equally to painted and unpainted aluminium and canvas surfaces, but there were no eggs on surfaces that had been smudged with oil from the motors ; if it is true that eggs are not laid on oil-coated surfaces, this should be considered in connection with possible control measures. The number of egg-masses on a plane varied from one to approximately 1,000, and many first-instar larvae were observed on one that had landed about 10ft. from some vegetation.

GUTHRIE (F. E.). **Effect of Temperature on Toxicity of certain organic Insecticides.**—*J. econ. Ent.* **43** no. 4 pp. 559-560, 11 refs. Menasha, Wis., 1950.

In tests of the effect of temperatures of 14·5, 22 and 32°C. [58·1, 71·6 and 89·6°F.] on the toxicity of five insecticides applied topically to *Blattella* (*Blatta*) *germanica* (L.), DDT, pyrethrum and lindane [at least 99 per cent. γ benzene hexachloride] were most toxic at the lowest temperature and least toxic at the highest, whereas the reverse was true for dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene] and aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-diendomethanonaphthalene]. The results obtained with the benzene hexachloride were quite variable, but the general trend was maintained throughout, and was the opposite of that observed by Hoffman, Roth & Lindquist [*R.A.E.*, B **38** 153–154].

SCALES (A. L.), IVY (E. E.) & RAINWATER (C. F.). **Preliminary Evaluation of two Nitroparaffin Insecticides against four Cotton Insects.**—*J. econ. Ent.* **43** no. 4 pp. 560–561. Menasha, Wis., 1950.

Dusts containing 2-nitro-1,1-bis(parachlorophenyl)propane and 2-nitro-1,1-bis(parachlorophenyl)butane, which are referred to below as P and B, respectively, were tested against cotton pests in cage experiments in Texas in 1949. A 20 per cent. toxaphene dust was used for comparison. The insects were adults of *Anthonomus grandis* Boh., third-instar larvae of *Heliothis armigera* (Hb.) and *Alabama argillacea* (Hb.), and third- and fourth-instar larvae of *Estigmene acraea* (Dru.) ; the dusts were applied at rates of 10 lb. per acre against the first three and 15 lb. against *Estigmene*, and their effectiveness was estimated by Abbott's formula [*R.A.E.*, A **13** 331] on the basis of mortality after five days.

In tests in field cages, the percentages of *Anthonomus* killed were 32, 48 and 59 for 2·5, 5 and 10 per cent. P, 53, 70 and 78 for 5, 10 and 20 per cent. B, 31, 69 and 80 for mixtures of the two at their three concentrations, and 99 for toxaphene. The corresponding percentages of *Heliothis* were 35, 29 and 32 for the three P dusts, 55, 85 and 92 for the B dusts, 36, 91 and 94 for the mixtures, and 88 for toxaphene.

The other two insects were exposed in greenhouse cages on cut branches standing in water. The percentages of *Alabama* killed were 56, 80 and 92 for 5, 10 and 20 per cent. P, 97, 100 and 100 for 5, 10 and 20 per cent. B, and 98 for toxaphene. Those of *Estigmene* were 50 for toxaphene, 96, 100 and 100 for 5, 10 and 20 per cent. B, 91, 100 and 100 for the mixtures of B and P at the concentrations tested against *Anthonomus*, and only 37 for 20 per cent. P alone, indicating that, in this case, the toxicity of the mixtures was mainly due to their B content.

HOFMASTER (R. N.) & DANIELSON (L. L.). **Toxicity of Dinitro Ortho Secondary Amyl Phenol to the Two-spotted Spider Mite on Strawberry Plants.**—*J. econ. Ent.* **43** no. 4 pp. 561–562, 1 ref. Menasha, Wis., 1950.

During experiments in which sprays of a herbicide containing 75 per cent. dinitro-o-sec.-amylphenol with an oil in water were shown to give practical control of winter weeds such as *Stellaria media* and *Lamium amplexicaula* in strawberry fields in Virginia, it was observed that the strawberry plants in the treated fields were virtually free from infestation by *Tetranychus bimaculatus* Harvey, which was heavy in untreated fields, and this observation was supported by others in commercial fields.

A field study was therefore carried out in the winter of 1949–50 of the effect of treating strawberries with a spray of 1 quart of the herbicide and 6·5 gals. kerosene in water to make 100 gals. applied at rates of 25, 50 and 100 U.S. gals. per acre. Preliminary tests on small plots showed that all treatments gave high mortality of the mite, which increased with the rate of application and, to some extent, with the number of days between application and evaluation. The results were so promising that the test was repeated on large replicated plots, which were treated on 1st February with a power sprayer at a pressure of 250 lb. per sq. in. The percentages of mites dead on 3rd and (in brackets) 6th February were 98·3 (99·4), 99·0 (99·4) and 99·9 (99·9) on plants sprayed with 25, 50 and 100 U.S. gals. per acre, and 13·9 (18·8) on untreated plants.

DAVIDSON (R. H.). **An effective Ant Bait Formula.**—*J. econ. Ent.* **43** no. 4 p. 565, 2 refs. Menasha, Wis., 1950.

An infestation of the whole of a large building at Columbus, Ohio, by *Monomorium pharaonis* (L.), which was damaging insect cultures and museum specimens, was eliminated by the use of a bait containing 5·5 gm. thallium sulphate, 3 oz. extracted honey, 1 lb. granulated sugar, 1 U.S. pint water and 0·5 gm. sodium benzoate. The bait should be prepared in a chemical hood as the vapours given off are very poisonous, the thallium sulphate being stirred into the mixture of the other materials when they are almost boiling. A container that prevented the bait from drying consisted of a cardboard pillbox with one or two holes punched through the side of the lid to permit access of the ants and with the lower part of the inside coated with paraffin wax. Only a small amount of bait need be put in each box, but a number of boxes should be used if the infestation is widespread.

FLOCK (R. A.). *Empoasca bipunctata* **introduced into California.**—*J. econ. Ent.* **43** no. 4 p. 565, 1 ref. Menasha, Wis., 1950.

It is reported that *Empoasca bipunctata* (Osh.) has been found to be a common pest of elms in southern California, where it is most common on Chinese elm [*Ulmus pumila*]. It causes a white stippling of the leaves, heavily infested trees suffering considerable defoliation, but has been controlled by DDT dust. It appears to breed only on elm, but disperses to many other plants, including *Citrus*.

BRINDLEY (T. A.), SCHOPP (R.) & HINMAN (F. G.). **Effect of initial high Dosages of DDT on the Yields of Peas and Wheat.**—*J. econ. Ent.* **43** no. 4 pp. 565–567, 1 fig., 4 refs. Menasha, Wis., 1950.

In connection with experiments on the value of DDT against insects attacking the leaves or pods of peas, investigations were made in Idaho on the growth and yield of peas and wheat in soil (Genesee loam) with which DDT had been mixed to a depth of 7–8 ins. In order to ensure even distribution, a 50 per cent. DDT concentrate was diluted with pyrophyllite to contain 10 per cent. DDT. In plots treated with 80 lb. DDT per acre in 1946, the growth of peas sown in the spring of 1946 was affected throughout the season and the yield was reduced by 48–54 per cent. ; winter wheat sown in the autumn of 1946 was unaffected, but peas sown in the spring of 1948, after the wheat stubble had been forked in to approximate the usual autumn ploughing, yielded 12–15 per cent. less than peas in untreated soil. In soil treated with 80 lb. DDT per acre in 1947, the yields of peas grown in 1947 and 1948 were reduced by 24–32 and 18–25 per cent., respectively. In soil treated with 20, 40 or 80 lb. per acre in 1948, peas grown the same year were not affected, possibly because the spring was unusually wet and a dense growth of green weeds 6–8 inches tall, which was forked in when the seed bed was prepared, prevented the compound from entering the plants. There was no weed growth on the plots treated in 1946 and 1947.

It is pointed out that 80 lb. DDT per acre represents a concentration in soil far in excess of any that would accumulate from applications to the plants against insects ; the maximum amount of DDT that would be required to control severe infestations on peas would be approximately 6 lb. per acre in any one season.

IGLINSKY jr. (W.) & RAINWATER (C. F.). *Orius insidiosus*, **an Enemy of a Spider Mite on Cotton.**—*J. econ. Ent.* **43** no. 4 pp. 567–568, 2 refs. Menasha, Wis., 1950.

It was observed in the summer of 1948 that *Orius insidiosus* (Say) was by far the most important natural enemy of *Septanychus* [*texazona*, McG.] on cotton on the Brazos River near College Station, Texas. The bug was not found on several plants examined during the winters of 1948–49 and 1949–50, except on cotton growing in a greenhouse in February 1950, but probably overwinters as a mature female, or possibly in the egg stage, as adults were abundant on goldenrod [*Solidago*] in October 1948, and ten females collected from it and kept at 80°F. lived for 45 days, apparently without feeding, and deposited only ten eggs. They died when the relative humidity became very low. The goldenrod on which the bugs were found was blooming profusely and was heavily infested with thrips, and males, which had not been found on cotton, were present on it, though much less numerous than females. It seemed possible that the males prefer to feed on pollen and the females on mites or insects. Mating was observed, but only an occasional immature bug was found, and all the bugs disappeared when there were no more flowers.

On several occasions during the summer, females collected on cotton were brought into the laboratory and supplied with cotton seedlings heavily infested with *Septanychus*. They oviposited freely, but no bugs were reared past the third instar, possibly owing to low humidity. Detailed life-history studies of 30 females and 17 males were, however, made during July and August 1949 at a mean temperature of 87·2°F. and a mean humidity of 48·8 per cent. The nymphal instars lasted 3·3, 1·9, 1·9, 1·2, 1·5 and 2·3 days and the total period from egg to adult 12·1 days. The young nymphs began to feed on eggs, nymphs or adults of *Septanychus* within a few minutes of hatching. The numbers eaten increased during the first four instars, but nymphs of the fourth and fifth instars ate as many adult mites as the mature bugs. Four adult females collected from cotton consumed an average of 16 mites per day, lived 6–9 days and deposited 21–36 eggs at the rate of 0–7 per day.

YUST (H. R.), WELBORN jr. (I. R.) & NELSON (H. D.). **Nylon Tents for Fumigation of** *Citrus*.—*Calif. Citrogr.* **33** no. 9 pp. 382, 405–406, 2 graphs, 2 refs. Los Angeles, Calif., 1948.

YUST (H. R.). **Orlon Tent for** *Citrus* **Fumigation with Hydrocyanic Acid.**—*J. econ. Ent.* **43** no. 4 p. 569, 1 ref. Menasha, Wis., 1950.

The first of these papers contains an account of further tests, made in 1947, of nylon tents for the fumigation of *Citrus* trees in California [*cf. R.A.E.*, A **38** 78]. Orange and lemon trees were fumigated with 14-, 18-, 20-, 22- and 24-cc. schedules, the lowest being used against *Lepidosaphes beckii* (Newm.) on orange. The concentration of hydrocyanic acid gas was greater and the kill of *Aonidiella aurantii* (Mask.) higher under cotton than under nylon tents throughout the exposure, but examination of the cotton tents showed that they had shrunk by as much as 1½ inches per foot since the measurements were painted on them, and this shrinkage partly accounted for the differences. The nylon tents showed no shrinkage, but it would be advisable to check the effect of longer use. Another possible reason for consistently higher concentrations in cotton tents is that the heavier cotton is more resistant to the measuring tape. In tests in which differences in measurement were eliminated, the leakage was the same through cotton and nylon when the tents were dry and there was no breeze, but slightly greater through nylon when the breeze was strong enough to cause appreciable rippling of the nylon and perceptible but less movement of the cotton fabric. At high humidities, when cotton tents were damp, nylon tents were covered with a film of water, and under these conditions the concentration was higher under nylon throughout exposure, averaging 20·6 per cent. higher than under cotton, and the kill of *Aonidiella* in the second moult averaged 87·6 per cent. under the cotton tents and 98 per cent. under nylon. Tests of wet nylon for porosity showed that practically no air penetrated it with a pressure of ¾ inch water. Wet duck and drill cotton fabric remained more porous than wet nylon. Special calendering greatly decreased the flow of air through dry nylon in tests with the porosity meter, but caused no difference in the tents.

In the field the average concentrations ranged from 0·73 to 1·43 mg. per litre under cotton tents and from 0·66 to 1·63 mg. per litre under nylon tents. The tendency to greater variation in gas concentration due to weather conditions is an undesirable characteristic of the nylon tents, as it necessitates adjustments in schedule to give the desired concentrations. Other disadvantages are that the tents float when being pulled from tree to tree and must be allowed time to settle. The packing of tents is also delayed by this tendency, and the rolled tents fall apart too readily because of the smooth surface. Also, in groves with tall cover crops, the light tent skirts do not weigh down the plants ; tents with nylon centres and cotton drill skirts appear to be a promising compromise. Although nylon cloth resists tearing when new, it could be torn more readily than duck or drill cotton cloth after exposure to the weather for six months on the roof of a building.

In the second paper, it is reported that a new synthetic fibre (Orlon) is more stable than nylon when exposed to sunlight and high temperatures. The fabric has a hard finish, weighs approximately 3·94 oz. per square yard and is 0·0091 inch thick. In regular commercial fumigation with 16- and 18-cc. schedules for 45 minutes, the average concentration of hydrocyanic acid gas was 0·8 mg. per litre under Orlon and 0·9 mg. per litre under cotton when the tents were dry, 0·99 under Orlon and 0·93 under cotton when they were wet with dew, and 1·39 under Orlon and 1·31 under cotton in four comparisons under wet conditions, showing that Orlon is similar to nylon in gas retention.

Orlon is lighter than the cotton duck and drill in general use, but not so strong as nylon of the same weight. An Orlon tent was as easy to handle as those of nylon and did not appear to shrink or stretch. Hydrocyanic acid gas had no apparent deleterious effect on the fabric, and being buried in the soil for three months did not affect it. After exposure on a roof for about ten months, Orlon lost little strength and nylon showed no strength ; the tensile strength of nylon was lost much more slowly in field use than in roof exposure tests.

Stohlman (E. F.), Thorp (W. T. S.) & Smith (M. I.). **Toxic Action of Chlordan.** —*Arch. industr. Hyg. occup. Med.* **1** pp. 13–19, 1 graph, 9 refs. Repr. (with additions) 7 pp. Chicago, Ill., 1950.

The following is virtually the authors' summary. The acute toxicity of chlordan is somewhat lower than that of DDT when the compounds are fed to rats in their diet [*cf. R.A.E.*, A **36** 339], the median lethal dosages being 250 and 150 mg. per kg., respectively. The acute toxicity of the two compounds is about the same (300 mg. per kg.) when they are fed to rabbits. Death from oral chlordan poisoning may be delayed for many days. The chronic toxicity of chlordan is considerably greater than that of DDT in both rats and rabbits ; this appears to be due to its greater cumulative action.

Like DDT, chlordan when administered continuously to rabbits results in focal necrosis of the liver and congestion, oedema and exudates of the lungs. In addition, it produces degenerative changes in the intestinal submucosa and in the convoluted tubules of the kidneys. Organically bound chlorine is excreted in the urine of rabbits receiving chlordan orally. The chlorine test is not specific for chlordan, but in the absence of other chlorinated organic compounds, it may be used as an aid in the diagnosis of chlordan poisoning or in the control of incipient poisoning under continued exposure to chlordan.

CARTER (R. H.), HUBANKS (P. E.), MANN (H. D.), ALEXANDER (L. M.) & SCHOPMEYER (G. E.). **Effect of Cooking on the DDT Content of Beef.**—*Science* **107** no. 2779 p. 347 repr. 3 pp., 4 refs. Lancaster, Pa., 1948.

One of a herd of cattle that had received DDT in clover hay from 5th January to 1st April was slaughtered on 10th May, and the carcass was kept in cold storage until December. Beef from it was then cooked by five methods or left uncooked and tested for DDT content. Chemical analysis indicated that the DDT in the beef was not materially decomposed or lost during roasting, broiling, pressure cooking, braising or frying.

KUENEN (D. J.). **De perebloesemkever** (*Anthonomus pyri* **Koll.) in Nederland.** [*A. piri* in Holland.]—*Tijdschr. PlZiekt.* **55** pt. 1 pp. 2–22, 11 figs., 4 refs. Wageningen, 1949. (With a Summary in English.)

An account, based on observations in 1945–48, is given of the bionomics of *Anthonomus piri* Koll. on pear in Holland, where its importance has been underestimated. Its eggs are laid in the fruit buds between September and December; those laid in September hatch in early November [*cf.* *R.A.E.*, A **34** 362] and the others in the following spring. The larvae feed and pupate within the buds, and the adults emerge in the latter half of May. They feed for a little on the buds and then aestivate until the beginning of September, when feeding is resumed and eggs are laid. Aestivating adults were found only on pear trees, beneath the bark and in cracks. The weevil is widely distributed in Holland, but its rate of spread is apparently slow. Adults were not observed to fly. Damage is caused not only by oviposition and larval feeding but also by the feeding punctures of the adults, which facilitate the entry of moulds, so that the buds rot and drop off. Both fruit and leaf buds are attacked. Oviposition and feeding occurred at 0°C. [32°F.], and continue until the onset of severe frosts. The percentages of buds damaged in different parts of the country averaged 25, but ranged from 0 to 98 in individual orchards.

Control of the weevil is best directed against the adults after they have resumed activity in autumn, and DDT sprays should be applied as soon as the first signs of feeding are observed. Since spraying so late in the year is useless against other pests, however, it is suggested that the percentage of buds damaged in the preceding spring should be taken as the criterion. If this was less than 2, spraying is not necessary, but if it exceeded 15, a thorough spray should be applied. Owing to the slow rate of reinfestation, this will give control for 2–3 years or more.

DE FLUITER (H. J.). **Over de voedselplanten van de zwarte bonenluis,** *Aphis* (*Doralis*) *fabae* **Scop.** [On the Food-plants of the Black Bean Aphid, *A. fabae*.]—*Tijdschr. PlZiekt.* **55** pt. 2 pp. 69–87, 27 refs. Wageningen, 1949. (With a Summary in English.)

The investigations described were carried out as a result of a heavy infestation by black Aphids of the group of *Aphis fabae* Scop. that broke out on *Philadelphus* in the arboretum at Wageningen in the spring of 1947. The Aphids were at first thought to be *A. fabae*, but not all of them could be established on broad bean (*Vicia faba*), the characteristic summer food-plant for that species, though some of them appeared to be identical with *A. fabae* in biology and morphology. The summer food-plant of the *Philadelphus* Aphids appeared to be *Cirsium arvense*.

In the experiments, *A. fabae* was reared throughout the year on broad bean in the laboratory. Artificial light from day-light lamps to give a day of 16 hours in winter was beneficial, as it hindered the development of sexual forms and increased fecundity, but was not essential. Cultures of Aphids were reared from single winter eggs or adult apterae. These and also field-collected Aphids were used in food-plant transfer experiments. When alates were used, their wings were first cut.

Observations on the hatching of the winter eggs of *A. fabae* on *Euonymus*, its principal winter food-plant in Europe, were made in 1947 and 1948 in the arboretum. Although warm weather did not set in until mid-March in 1947 and the eggs did not hatch in numbers until 2nd April, whereas they hatched a month earlier in 1948, the spring migrants, which made up most of the first fundatrigenia generation, left *Euonymus* at about the same date, mid-May, in both years. This was due to acceleration of growth by the warm weather in 1947 and retardation by cold in 1948. The apterae remaining on the trees were quickly destroyed by the larvae of Coccinellids (*Adalia bipunctata* (L.) and *Coccinella septempunctata* L.), Syrphids and Hemerobiids, and no Aphids were left on *Euonymus* by the end of May. Only two generations, fundatrix and fundatrigenia, had developed on the trees in either year, and both were reared in the laboratory successfully on broad bean, numerous alatae appearing among the progeny of the fundatrices.

In experiments on the winter food-plants of *A. fabae* [*cf. R.A.E.*, A **35** 39], gynoparae transferred from the cultures to *Viburnum opulus* in October 1947 soon gave rise to oviparae. These were fertilised by males from the cultures and deposited winter eggs. The eggs hatched in March 1948, and the fundatrices developed normally, as also did fundatrices that hatched on *E. europaeus* and were immediately transferred to *V. opulus*. Young fundatrices that hatched from eggs laid by autumn migrants on *Viburnum* were transferred to broad bean and completed normal development. Although *A. fabae* overwinters on both *Euonymus* and *Viburnum*, *E. europaeus* was preferred to *V. opulus* in the arboretum.

Eggs deposited on *Philadelphus* in the arboretum in the autumn of 1946 hatched in the spring and the fundatrices developed normally when transferred to broad bean, indicating that they were *A. fabae*. Gynoparae of *A. fabae* from the cultures deposited their young on *Philadelphus*, the fertilised oviparae subsequently oviposited, and the fundatrices that hatched in spring developed normally when transferred to broad bean. Gynoparae and males of the *fabae* group were common on *Philadelphus* at Zeist in the autumn of 1947, and gynoparae brought to the laboratory produced oviparae on *P. pubescens* that paired and oviposited on the twigs. Fundatrices hatched in spring and developed normally on broad bean. It is concluded that *Philadelphus* is one of the winter food-plants of *A. fabae* in Holland, although it is of little importance when compared with *Euonymus*. It is of greater significance as a summer food-plant.

Large numbers of gynoparae of the *fabae* group migrated to *Deutzia* spp. in the arboretum in the autumns of 1947 and 1948, and winter eggs were laid by the oviparae, though they were scarce. The same appeared to have occurred in 1946, and the few fundatrices found in the springs of 1947 and 1948 developed normally on broad bean. Very little infestation appeared in spring on *Deutzia* itself, which is attributed to some unfavourable food factor affecting the young fundatrices, and tests in which fundatrices that hatched on *Euonymus* were transferred to *D. scabra* tended to confirm this view. Alate gynoparae from the cultures that were transferred to *D. scabra* in the autumn of 1947, however, became readily established and oviparae developed, though somewhat slowly. Early leaf fall prevented them from maturing and no eggs were laid. *Deutzia* spp. in the arboretum seemed to be more attractive to gynoparae of the *fabae* group than *Philadelphus*, but their importance as winter food-plants appears to be small.

Euonymus in the arboretum was infested in autumn and spring, and tests in which young fundatrices were transferred to broad bean showed that not only *A. fabae* but also *A. euonymi* F. was present. The characteristic summer food-plant of the latter is *Solanum nigrum*. A list is given of the species of *Euonymus* affected. In 1948, eggs of *A. fabae* on twigs of *Euonymus* brought into the laboratory on 11th February and kept at an average temperature of 18°C. [64·4°F.] hatched from 15th February. Winter eggs laid on broad bean in November–March by fertilised females of the laboratory culture, however, failed to hatch, probably because of the high laboratory temperatures. In addition to oviparae and winter eggs, a few immature gynoparae and apterous virginogeniae of *A. fabae* were observed on the semi-evergreen *E. bungeana* var. *semipersistens* as late as 17th December in 1948, although the temperature had fallen to −7·1°C. [19·2°F.] in late November.

In tests with newly hatched fundatrices of *A. fabae*, colonies were established on broad bean, *Viburnum opulus*, *Philadelphus* spp., *Deutzia scabra*, *Magnolia stellata* var. *rosea*, pear, *Sorbus aucuparia*, *Buxus sempervirens* var. *glauca*, *Rumex giganteus*, *R. obtusifolius*, *Matricaria chamomilla* and *Arctium minus*, though they survived for only 2–3 weeks on *Deutzia*, *Magnolia* and *Buxus*, and fundatrices in the third and fourth instars became established on *Rheum macropterum*.

Tests were also carried out with apterous and alate virginogeniae of *A. fabae*. They failed to become established on *Cirsium arvense*, and black Aphids taken on this plant in the field failed to establish themselves on broad bean. The black Aphid on *C. arvense* is apparently *A. euonymi*, although alates of *A. fabae* occasionally found colonies on it [*cf. loc. cit.*]. *A. fabae* was easily transferred to *Philadelphus* spp., but some of the Aphids on *Philadelphus* in the arboretum could not be established on broad bean, though they could on *C. arvense*, so that in addition to *A. fabae*, there is apparently another species of the group on *Philadelphus*. It is not known whether it is *A. philadelphi* Börn., but *A. euonymi* from *Solanum nigrum* was easily transferred to *Philadelphus*. *A. fabae* did not become established on *S. nigrum*, and though summer migrants of that species were occasionally observed to reproduce on it, their progeny did not reach the adult stage. Negative results were obtained with *Arctium minus* and *A. vulgare*, though field evidence was obtained that *Aphis fabae* occasionally infests *A. minus*. Establishment on *Rumex* spp., was readily achieved.

FRANSEN (J. J.). **Gevoeligheid van de eikenaardvlo voor DDT en HCH.** [The Susceptibility of the Oak Flea-beetle to DDT and BHC.]—*Tijdschr. PlZiekt.* **55** pt. 2 pp. 92–95, 8 refs. Wageningen, 1949. (With a Summary in English.)

In view of a report by G. van Rossem that adults of *Haltica quercetorum* Foudr. (oak flea-beetle) that migrated to strawberry beds at Veenendaal in Holland were readily controlled by dusting with Gesarol (5 per cent. DDT) but that this treatment was obviously too expensive for use in woods, the author points out that the dust was not used at the lowest effective concentration. In tests in which overwintered adults were shaken up with various dilutions of the Gesarol dust and then freed from excess powder and kept on paper in glass vessels, 0·05 per cent. DDT gave complete mortality, so that still greater dilutions would probably also be effective. In similar tests with BHC (benzene hexachloride) [*cf. R.A.E.*, A **36** 296], two dusts of English origin diluted to contain 0·006 and 0·007 per cent. γ isomer gave complete mortality of adults but a Belgian material was not effective at less than 0·019 per cent. The larvae were more resistant, and 0·1 per cent. or less γ isomer failed to give a complete kill of full-fed individuals.

Bovien (P.). **Coloradobillens optraeden i Danmark 1949.** [The Appearance of *Leptinotarsa decemlineata* in Denmark in 1949.]—*Tidsskr. Landøkon.* 1949 pp. 507–515, 2 figs. Copenhagen, 1949.

Leptinotarsa decemlineata (Say) was observed in Denmark for the first time in 1949 when adults, larvae and pupae were taken on potato at several places in southern Jutland between 24th July and 26th September. Some of the adults had undoubtedly developed locally and belonged, like the larvae and pupae, to the summer generation. It was feared that the beetle would become established, but climatic conditions in Denmark are likely to prevent the production of a full second generation in the year. Notes are given from the literature on the distribution of the beetle in Europe and on its behaviour in Holland, and the usual control measures are recommended.

Wahlin (B.). **Nya parasitangrepp på oljelin.** [New Parasite Attacks on Linseed.]—*Växtskyddsnotiser* 1948 no. 6 pp. 88–90. Stockholm, 1948.

It is reported in the course of this paper that the flea-beetle that attacked flax grown for oil-production in Östergötland, Sweden, in 1946 and was at first recorded as *Chaetocnema concinna* (Marsh.) [*R.A.E.*, A **37** 322] has proved to be *Aphthona euphorbiae* (Schr.), which was previously known only from *Euphorbia* in the south of the country. The infestation recurred in the two following years. It begins as soon as the plants appear above the ground and persists until late in the summer. DDT dusts are effective, but repeated applications are required.

Borg (Å.). **Blodlusinventeringen i Skåne 1945–1948.** [The Survey of *Eriosoma lanigerum* in Skåne in 1945–48.]—*Medd. St. Våxtskyddsanst.* no. 53, 42 pp., 11 figs., 20 refs. Stockholm, 1949. (With a Summary in English.)

The following is based on the author's summary. *Eriosoma lanigerum* (Hsm.) was first found to be established in Sweden in 1930, on apple near Malmö, where it had apparently been present for at least two years. It spread over most of the west of Skåne during the next ten years and threatened the apple-growing districts in the north-west and east of that province, and in 1945, regulations were issued requiring infested trees to be reported, forbidding the movement of infested material, and providing for the application of official control measures. In the same year, a buffer zone about 6 miles wide was established at the eastern edge of the infested zone from north to south, to prevent further spread. Every apple tree in it was examined in summer, since the infestation recedes in winter [*cf. R.A.E.*, A **37** 455], and only 96 trees in 23 plantings were found infested. The survey was complete by December 1948. Seriously infested trees were cut down, and the others scraped and sprayed with 8–10 per cent. tar distillate in winter and 0·15–0·2 per cent. nicotine with a wetter (alcohol or oil emulsion) in summer. These measures were not successful in all cases, but ten orchards were freed from infestation.

Borg (Å.). **Ett vinterbesprutningsförsök mot blodlusen och ett par andra skadeinsekter.** [A Test of Winter Sprays against *Eriosoma lanigerum* and a few other Pests.]—*Växtskyddsnotiser* 1949 no. 1 pp. 4–6, 1 fig. Stockholm, 1949.

In a test in 1948 in a neglected apple orchard near Lund in which infestation by *Eriosoma lanigerum* (Hsm.) and Lepidoptera was heavy, plots consisting of ten trees each were sprayed on 25th March with a tar distillate (fruit-tree carbolineum) at 8 per cent., a proprietary oil emulsion containing dinitro-o-cresol also at 8 per cent., and a combined spray of 8 per cent. tar distillate and

8 per cent. of an oil emulsion specially recommended against the Aphid. Some of the trees were carefully scraped before treatment. Colonies of *E. lanigerum* were counted up to a height of about 6 ft. on the trees on 25th May and 17th June, and observations were also made on the latter date on infestation by larvae of *Hyponomeuta padellus malinellus* Zell., which overwinters on the trees as newly hatched larvae under the egg case, and *Malacosoma neustria* (L.), which does so in the egg stage. The three treatments reduced the average numbers of colonies of *Eriosoma* per tree in June on unscraped and (in brackets) scraped trees from 10·8 (6·4) in the controls to 1·8 (0·6), 2·8 (2·4) and 2 (1·3), respectively. The results against the Lepidoptera were uncertain ; the slight reductions in the average numbers of colonies of *Hyponomeuta* are considered unimportant, and there was no obvious reduction of *Malacosoma*, the larvae of which had begun to disperse at the time of the count.

VAN TIEL (N.). **The Retention of Methallyl Chloride and Methyl Bromide by fumigated Grain.**—*J. Hyg.* **46** no. 4 pp. 431–433, 3 refs. Cambridge, 1948.

In the experiments described, wheat was fumigated in a small chamber with 80 gm. methallyl chloride or 20 gm. methyl bromide per cu. m. for 24 hours at a temperature of 25°C. [77°F.]. The methallyl chloride was evaporated by a stream of air that was led into the fumigating chamber under pressure. When grain fumigated with it was ventilated by forced draught for two hours and then exposed to the air in normal storage, it contained 73–83 mg. methallyl chloride per kg. one minute after ventilation was begun, 55 mg. after two minutes, 8–13 mg. after 48 hours and 3–5 mg. after six days. When it was continuously ventilated by forced draught, it still contained 10 mg. per kg. grain after 48 hours, and it is concluded that small amounts of methallyl chloride may be retained by grain for some days after fumigation. Grain fumigated with methyl bromide showed no residues one minute after ventilation had begun.

To determine whether the residue of methallyl chloride constituted a danger to consumers, rats were fed for 6½ weeks on food containing 60 per cent. treated or untreated wheat ; the treated wheat had been fumigated for 24 hours with 80 gm. methallyl chloride or 20 gm. methyl bromide per cu. m. or immersed for five minutes in liquid methallyl chloride and had then been intensively ventilated for an hour, left exposed to the air and ground. During the test period, the rats were weighed three times a week, and after it, all of them were given normal food and weighed at intervals for another three weeks. Statistical analysis showed no significant differences in weight increase due to the different foods, and there was no mortality.

Previous investigations have shown that gaseous methallyl chloride is considerably less dangerous than methyl bromide to rats, and the results here reported indicate that the residues remaining in grain cannot be considered dangerous to consumers.

TAYLOR (K. L.). **High-ringing as a possible Method of controlling** *Lyctus*.—*N.S.W. For. Rec.* **1** no. 1 pp. 17–22, 12 refs. Sydney, 1948.

Work on the value of ringing the trunks of standing trees at a considerable height in order to reduce the starch content of the sapwood and so render it immune from attack by *Lyctus* spp. [*R.A.E.*, A **28** 450 ; **31** 265 ; **35** 247] is reviewed, and an account is given of experiments in New South Wales. Spotted gum trees (*Eucalyptus maculata*) that were ringed at a height of 25 ft. or more in February 1941 and felled in February 1942 and others that were ringed in August 1941 and felled in May or October 1942 were free from starch or contained insufficient to make them susceptible to attack by *Lyctus*. Trees of five rain-forest species were ringed in September 1940 and February and June 1941, but in February 1942, resorption of starch was far from complete in any of them, and starch was still present in some of the trees in November 1945. The method is considered to be practicable and not unduly costly in the case of *E. maculata*, the sapwood of which is narrow, but cannot at present be recommended for rain-forest species. Climbing spurs were more satisfactory for the men carrying out the treatment than either climbing stirrups or extension ladders, and the marks left by them did not provide means of entry for pin-hole borers or fungi, as was at first thought probable.

TAYLOR (K. L.) & HADLINGTON (P. M.). **Forest Insects in New South Wales.**—*N.S.W. For. Rec.* **1** no. 1 pp. 42–47, 8 figs. Sydney, 1948.

The insects dealt with are the Limacodid, *Doratifera vulnerans* (Lewin), and the weevil, *Aesiotes notabilis* Pasc., the bionomics and control of which are reviewed from investigations in Queensland [*R.A.E.*, A **34** 258–260], and which has so far not proved injurious in New South Wales, and *A. leucurus* Pasc., which attacks many introduced conifers, including *Pinus radiata*, and native species of *Callitris* and is common on ornamental *Cupressus* in Sydney [*cf.* **27** 602]. Observations indicate that *A. leucurus* attacks trees that are weakened by unfavourable conditions as well as damaged ones ; many exotic *Cupressus* trees survive for only a few years in Sydney, and though this is not entirely due to attack by *A. leucurus*, it is generally found to be associated with their destruction. *D. vulnerans*, the larva and adult of which are described, attacks *Eucalyptus* spp. and was very active on the ornamental tree, *Tristania conferta*, in Sydney in 1945. The eggs are deposited on the leaves in masses covered by a dark brown, downy material from the body of the female and hatch after about six days. The larvae feed on the leaves and pupate in cocoons on the twigs. The larval stage lasted 40–65 days in the laboratory, and the adults emerged 42–345 days after the spinning of the cocoons ; this period may include a prepupal stage in which winter is passed. There was a similar variation in the time of emergence from field-collected cocoons. This Limacodid is normally present in very small numbers, but becomes a major pest under favourable conditions, probably when the resistance of the trees is reduced by drought. The outbreak may last for a year, but then dies down quickly, probably owing to natural control agents. Two Hymenopterous parasites, which are thought to have been largely responsible for the cessation of the outbreak in Sydney, were bred from the cocoons ; one was solitary and the other gregarious, an average of 12 adults emerging from each host.

HELY (P. C.). **The Value of DDT in Tomato Pest Control Programmes. Central Coast Experiments.**—*Agric. Gaz. N.S.W.* **60** pt. 9 pp. 485–489, 2 refs. Sydney, 1949.

Tests of treatment against pests of tomato in the Central Coast district of New South Wales [*cf. R.A.E.*, A **37** 41] were made in 1946 and 1947. In 1946, plants of the autumn crop were treated nine times between 25th January and 26th April ; bordeaux mixture (1 : 1 : 40) was included in all spray applications and ½ or 1 lb. colloidal sulphur per 40 gals. spray in four of the nine. The mean percentages of fruits damaged by the tomato caterpillar [*Heliothis armigera* (Hb.)] and, in brackets, infested by the potato moth [*Gnorimoschema operculella* (Zell.)] were 10·34 (0·94) for no treatment, 0·73 (0·37) for 3 lb. lead arsenate per 40 gals., 0 (0·03) and 0·13 (0·02) for 0·06 and 0·03 per cent. DDT, respectively, as an emulsified solution, 0·49 (0·08) for 0·075 per cent. BHC (benzene hexachloride) as an emulsified solution, 6·2 (1·04) for bordeaux mixture and colloidal sulphur alone, and 0·02 (0·06) for a dust of 1 per cent.

DDT, 40 per cent. sulphur and 10 per cent. copper sulphate. All treatments gave satisfactory control of the tomato mite [*Phyllocoptes lycopersici* Massee], the dust having the most persistent effect, and none harmed the crop. In 1947, 15 applications were made at weekly intervals from 10th January until mid-May. DDT was applied in sprays at 0·05 per cent. as an emulsified solution, alone or with bordeaux mixture or bordeaux mixture and dispersible or colloidal sulphur, and as a wettable powder with bordeaux mixture and dispersible sulphur, and in a dust at 1 per cent. with 10 per cent. copper carbonate and 30 per cent. sulphur. All treatments gave complete or almost complete control of *G. operculella*, which was not abundant, *H. armigera*, against which the sprays were better than the dust and the emulsions better than the suspension, and Aphids, and no damage by *P. lycopersici* occurred, even when sulphur was omitted, though untreated plants in close proximity to the treated ones were defoliated by this mite [*cf.* **34** 385]. If DDT sprays are to be used against it, however, care must be taken to apply them to the main stem.

Tests were also made in both years, on the control of *Thrips tabaci* Lind., an important vector of spotted wilt disease, on the spring crop. In 1946, when the test plants had been sprayed weekly with 0·1 per cent. DDT as an emulsified solution in the seed bed and the experimental schedule included ten weekly applications between 16th October and 19th December of sprays containing 0·1 or 0·05 per cent. DDT prepared from mayonnaise-type or miscible emulsion concentrates and dusts containing 2 per cent. DDT or BHC, the sprays reduced infection by spotted wilt to 34·56–43·35 per cent. and the dusts to 52·4 and 67·34 per cent., respectively, as compared with 73·45 in the controls. In 1947, the experimental treatments were applied between 22nd October and 22nd December to plants that had been sprayed twice weekly in the seed bed and after they were set out in early October with 0·1 per cent. DDT. The percentage infection in the control plants, which received an occasional spray of bordeaux mixture only, was 30·57. This was reduced to 17·06 by weekly sprays of 0·05 per cent. DDT in bordeaux mixture (1 : 1 : 40), to 10·09–10·79 by the same spray alternated at half-weekly intervals with a bait-spray of 1 oz. tartar emetic and 4 oz. white sugar in 4 gals. water, with an emulsified solution of 0·05 per cent. DDT alone, or with a 1 per cent. DDT dust, to 11·71 by a dust of 1·5 per cent. DDT and 10 per cent. copper carbonate similarly alternated with the bait-spray, and to 4·5 by a spray of 0·1 per cent. DDT applied twice weekly, alternately with and without bordeaux mixture.

Analyses showed that the DDT residues on fruits from plants that received 20 spray applications of 0·1 per cent. DDT over 11 weeks, 20 applications of alternate dusts and sprays, and 15 of sprays containing 0·05 per cent. DDT combined with different materials or of the 1 per cent. DDT dust with sulphur and copper carbonate were 1, 2 and less than 1 part DDT per million, respectively.

On the basis of this work, thorough routine applications of a spray containing 0·05 per cent. DDT with bordeaux mixture are recommended for the control of insect and fungous pests and of *P. lycopersici* [**37** 41], but a concentration of 0·1 per cent. is required to control spotted wilt ; if sulphur is to be included in the spray, the dispersible form is the safest and most satisfactory. Dusts of 1–2 per cent. DDT are slightly less effective than sprays and should not be used on young plants less than about 1 ft. high, since they tend to scorch the leaves. A combination of sprays and dusts provides the most effective schedule.

LAWREY (V. L.). **Orchard Pest Control. Departmental Demonstration Plot—West Tamar District.**—*Tasm. J. Agric.* **20** no. 3 pp. 182–187, 2 graphs. Hobart, 1949.

During the recent war, many apple orchards in Tasmania were neglected and the codling moth [*Cydia pomonella* (L.)] increased considerably. In order to enable growers to obtain the maximum benefit from the available insecticides, sprays were applied in a demonstration plot containing two varieties in 1947–48 and 1948–49. Cover sprays were timed by the activity of the moths, which was assessed by means of bait traps. In 1947–48, when a calyx and three cover sprays were applied, 0·1 or 0·05 per cent. DDT was more effective than lead arsenate (3 lb. per 100 gals. water) against *C. pomonella* and gave complete control of Jassids, which were abundant on the lead-arsenate trees, but infestation by the light brown apple moth [*Tortrix postvittana* (Wlk.)], Tetranychid mites and woolly Aphid [*Eriosoma lanigerum* (Hsm.)] was higher on trees sprayed with DDT. In the next season, the trees received an application of 5 per cent. dormant oil emulsion against Tetranychids on 26th August and this controlled them adequately, so that they were not injurious during the summer, even on the trees sprayed with DDT. The summer schedules comprised five applications of the lead arsenate spray or of 0·1 per cent. DDT and a similar schedule of lead arsenate in which 0·1 per cent. DDT was substituted in the second cover spray. In addition, some of the trees in each treatment received an extra application before the first cover spray, at the period of peak emergence of *Tortrix postvittana*. DDT gave complete control of *C. pomonella*, but was again of no value against *T. postvittana*, whereas lead arsenate gave good control of both species. The extra application against *T. postvittana* had no effect on the trees sprayed with DDT, but reduced damage from 7·2 to 4·5 per cent. on those that received five applications of lead arsenate and from 21·6 to 7·1 in those that received the mixed schedule. *Eriosoma lanigerum* was rather abundant, and was most numerous on the trees sprayed with DDT, but was fairly well controlled on all trees late in the season by its parasite, *Aphelinus mali* (Hald.). The eventual abundance of the latter on the DDT-sprayed trees was probably due to migration from neighbouring trees sprayed with lead arsenate.

Trap jars baited with 10 per cent. wine attracted more than twice as many moths as those baited with 10 per cent. molasses and gave evidence of activity when the others did not. The trapping results for moths of both species were considered to be sufficiently satisfactory to justify the operation of bait traps each year for the benefit of growers.

MILLER (L. W.). **The Effects of a D.D.T. Schedule on the Canary Fly** (*Typhlocyba froggatti*, **Baker**).—*Tasm. J. Agric.* **20** no. 4 pp. 246–247, 2 refs. Hobart, 1949.

Following the adoption of DDT for the control of the codling moth [*Cydia pomonella* (L.)] on apple in Tasmania, populations of *Typhlocyba froggatti* Baker have shown a marked decrease, and in 1947–48, a comparison was made of the numbers of nymphs present on trees that had received a lead-arsenate calyx spray followed by two cover sprays of lead arsenate or DDT as a wettable powder. The concentrations were 4 lb. lead arsenate or 1 lb. DDT per 100 gals. Samples of 20 leaves per tree from ten trees sprayed with lead arsenate and ten sprayed with DDT bore totals of 793 and 90 nymphs, respectively, and statistical analysis showed this difference to be highly significant. The leaves on the trees treated with lead arsenate were discoloured and the fruits spotted by the Jassids, but those of the trees treated with DDT were unblemished. Subsequent observations in other orchards confirmed the susceptibility of *T. froggatti* to DDT, a single application of which gave effective control in some cases. The effect of DDT on its introduced parasite, *Anagrus armatus* var. *nigriventris* Gir. [*R.A.E.*, A **36** 70], is unknown.

REYNE (A.). **Studies on a serious Outbreak of** *Aspidiotus destructor rigidus* **in the Coconut-palms of Sangi (North Celebes).**—*Tijdschr. Ent.* **89** (1946) pp. 83–123, 6 pls., 1 fig., 2 maps, 44 refs. Amsterdam, 1948.

A serious outbreak of *Aspidiotus destructor rigidus* Reyne occurred on coconut on the island of Sangi, North Celebes, in 1925–28. It was investigated by the author, who here gives an extract from his unpublished report, which was completed in 1933, supplemented by a few extra data. Much of the information has been noticed from his earlier papers [*R.A.E.*, A **18** 83; **37** 138–140]. Detailed accounts are given of the course of the outbreak, the damage caused, the studies that established the identity of the Coccid concerned, the characters that differentiate it from the typical *A. destructor* Sign., its life-history and distribution, and natural enemies. Possible causes of the outbreak are discussed.

Both *A. destructor* and *A. d. rigidus* were attacked by three species of fungi, one of them of the genus *Aschersonia*, but they were of no importance. The Coccinellids, *Telsimia nitida* Chapin, *Scymnus* (*Nephus*) *luteus* (Sic.) and *Chilocorus nigritus* (F.), were predacious on typical *A. destructor*, but afforded no control of *A. d. rigidus*, which they were unable to attack because of its tough cuticle. *C. politus* Muls. was introduced into Sangi and Boroko (North Celebes) from Java and liberated in 1928 in areas infested by *A. d. rigidus*. It became established in both localities, but had little effect on the Coccid. At Sangi, where it was reared on *A. d. rigidus*, the egg, larval and pupal stages lasted 7, 13 and 7 days, somewhat less than in Java. The parasites of *A. d. rigidus* included *Spaniopterus crucifer* Gah., *Aphytis chrysomphali* (Merc.), *Aspidiotiphagus citrinus agilior* Berl. and *Prospaltella aurantii* (How.). They are all parasites of typical *A. destructor* and were of no importance in the control of *A. d. rigidus*. Notes on their local distribution and bionomics are included.

SEIXAS (C. A.). **A prática do combate químico à broca do café.** [The Practice of chemical Control of the Coffee Berry Borer.]—*Biológico* **14** no. 4 pp. 71–89, 2 pls., 5 figs. São Paulo, 1948.

Control of *Stephanoderes* (*Hypothenemus*) *hampei* (Ferr.) on coffee by means of contact insecticides is directed against the fertilised females while they are migrating from the old berries in which they have developed to the young berries in which they oviposit and while they are entering these. BHC (benzene hexachloride) has been found in São Paulo to be more effective for the purpose than DDT or parathion (Rhodiatox) [*cf. R.A.E.*, A **39** 26], and two or more applications of a dust are recommended. This should contain 1 per cent. γ isomer if first applied early, when about 5 per cent. of the berries have been entered, and 2 per cent. if not applied until later. An apparatus for mixing the dust, and its application by ground machines or from aeroplanes or helicopters, are described. The aircraft proved efficient in preliminary tests, but have been little used so far.

de TOLEDO (A. A.). **Contribuição para o estudo da** *Leucinodes elegantalis* **Guén., praga do tomate.** [A Contribution to the Study of *L. elegantalis*, a Pest of Tomato.]—*Biológico* **14** no. 5 pp. 103–108. São Paulo, 1948.

With the increase in the cultivation of tomato in São Paulo, *Leucinodes elegantalis* Gn., all stages of which are briefly described, has become the most important pest of this crop [*cf. R.A.E.*, A **33** 94]. Since tomatos grown for the first time in a district are as heavily infested as those grown elsewhere, it seemed likely that wild plants are the normal sources of the infestation, and when the fruits of wild solanaceous plants in the district of Campinas were investigated, larvae of *L. elegantalis* were found in those of *Solanum palinacanthum*, *S. reflexum*, *S. ciliatum*, *S. sisymbriifolium* and *S. robustum*. The larvae have also been observed in fruits of egg-plant [*S. melongena*], pepper [*Capsicum annuum*], and giló [*S. gilo*]. The wild species of *Solanum* were found infested in 46 districts throughout the State. The life-history of the moth is described [*cf. loc. cit.*]. The egg, prepupal and pupal stages lasted 5–7, 2–5 and 14–20 days, depending on temperature, in the insectary, and the larvae, which feed on the seeds, became full-fed in 15–23 days in tomato and 21–28 days in wild *Solanum*. Females deposited up to 120 eggs each, with an average of 30. The adults are most abundant in January–June, and attack on tomato is most severe in March–April, corresponding to the period in which the wild species of *Solanum* produce their fruits.

The measures of control recommended are the destruction of all solanaceous weeds at least a month before the planting of tomato, followed by the use of ovicides as soon as the fruits develop. In laboratory tests, DDT gave no control of the newly hatched larvae when applied to the eggs. Field tests of ovicidal sprays were begun in 1944, when 15 weekly applications were made from mid-March until mid-May, and the percentage infestation was reduced from 51·7 for no treatment to 25·6 for 1 per cent. fish oil, and 11·5 and 4·5 for 1 and 2 per cent. of a mixture of equal parts of fish oil and diesel oil ; the emulsifier used was soap. There was no difference in the weight of fruit produced by treated and untreated plants. In 1946, the percentage infestation of untreated plants was 20 and this was reduced to 15·3 by 1 per cent. of the mixture of fish oil and diesel oil emulsified with 0·3 per cent. soap, and to 5·2 by 0·2 per cent. nicotine sulphate with 1 per cent. lime water (10 per cent.) or lime and 2 per cent. skim milk as wetter, applied weekly. Nicotine sulphate has the advantage that it also controls Aphids and can be applied with bordeaux mixture, which is usually applied to tomato at fortnightly intervals as a fungicide. It is therefore recommended.

MENEGHINI (M.). **Experiências de transmissão da doença "tristeza" dos citrus pelo pulgão preto da laranjeira.** [Experiments on the Transmission of the Tristeza Disease of *Citrus* by *Aphis citricidus*.]—*Biológico* **14** no. 5 pp. 115–118, 7 refs. São Paulo, 1948. (With a Summary in English.)

Some of the information in this account of experiments in the laboratory in São Paulo on the transmission of the virus disease of *Citrus* known as tristeza by *Aphis citricidus* (Kirk.) (*tavaresi* Del G.) is similar to that already noticed [*R.A.E.*, A **37** 319]. The Aphids were used in batches of 200 and destroyed by a spray of nicotine sulphate five days after being transferred to healthy plants. When the Aphids were collected from affected trees and starved for 0–28 hours before being transferred to healthy sweet orange grafted on sour orange, the percentage infection was not affected, but it was reduced when the period of starvation was increased to 48 hours. In order to test the susceptibility of sweet and sour orange to the disease [*cf.* **37** 320], plants of these varieties were exposed by placing on them Aphids from infected trees and, six weeks later, ten exposed sweet orange plants were grafted on unexposed sour orange, ten unexposed sweet orange on exposed sour orange, and ten exposed sweet orange on exposed sour orange. The numbers of plants that developed symptoms were 9, 2 and 10, respectively. It is concluded that sweet orange growing on its own roots can become infected with the virus, though it shows no symptoms, and that sour orange is much more resistant to it than sweet orange.

In breeding experiments, *Evodia hupehensis* proved a suitable food-plant for the Aphid, and its use avoided the danger that orange plants used for the purpose might be symptomless carriers of the virus. Aphids reared on it subsequently transmitted the virus from infected twigs to healthy sweet orange grafted on sour orange.

MALDONADO BRUZZONE (R.). **Informe sobre una gira al oriente boliviano en procura de datos sobre la formación de mangas de** *Schistocerca cancellata* **(Serville).** [Report on a Journey in eastern Bolivia in search of Data on the Formation of Swarms of *S. cancellata*.]—[*Publ.*] *Inst. Sanid. veg.* (A) **4** no. 38, 22 pp., 4 figs., 1 fldg. map, 9 refs. Buenos Aires, 1948.

Swarms of *Schistocerca cancellata* (Serv.), with which the author treats *S. paranensis* (Burm.) as conspecific [*cf.* *R.A.E.*, A **28** 215], periodically cause great damage in Argentina. They have been thought to originate in the Provinces of Catamarca and La Rioja, in the north, but little is known of their true breeding places or initial spread, since much of northern Argentina is sparsely inhabited and the areas concerned are vast. There was some evidence, however, that the swarms did not all originate within Argentina, and in 1946, when the author was in the north of the country and the locust population there was almost destroyed as a result of parasitism by *Sarcophaga* (*Acridiophaga*) *caridei* Brèth., swarms entered Argentina from Brazil and Paraguay in June by way of the Chaco. He observed one crossing the border from Bolivia in July. Since little was known of the development of the locust in that country [*cf.* **8** 476], the author made an expedition in October–November from Yacuiba, on the frontier, as far as Santa Cruz, in eastern Bolivia, in search of information. He describes the route taken and the numerous occasions on which locusts were observed. Swarms were encountered at several places, and solitary forms at many. Although it was October, there was little vegetation to be seen and the locusts examined were young adults with undeveloped ovules, presumably belonging to the second generation of the year. It was stated locally that oviposition occurred in November and also that the chief damage was caused by the second generation, which denuded pastures and left cattle without winter food. References in the literature to the occurrence of a second generation are reviewed, and its importance is considered to be greater than was before realised. It is concluded that the habitat of the locust includes central and northern Argentina, eastern Bolivia, part of the west and south of Brazil, the centre and north of Chile (where swarm formation is rare), Paraguay and Uruguay. The necessity for co-operative control measures and the interchange of information is emphasised.

NORRIS (M. J.) (MRS. O. W. RICHARDS). **Reproduction in the African Migratory Locust** (*Locusta migratoria migratorioides* **R. & F.**) **in Relation to Density and Phase.**—*Anti-Locust Bull.* no. 6, [2+] 48 pp., 7 graphs, 16 refs. London, 1950.

Laboratory experiments on the reproduction of *Locusta migratoria migratorioides* (R. &. F.) were carried out to test the validity of the hypothesis that locust outbreaks are due to an increased reproductive rate associated with the change from phase *solitaria* to phase *gregaria*. The following is based on the author's summary. The adult locusts used were from a strain that had been reared in isolation and showed most of the characters of phase *solitaria* and from one that had been reared in crowds and showed most of the characters of phase *gregaria*, and are referred to as *solitaria* and *gregaria*, respectively. The main comparison made was between the reproduction of *solitaria* adults isolated in pairs and *gregaria* adults that were crowded, but the effects of crowding on *solitaria* adults and of low density on *gregaria* adults were also investigated. Only such differences in reproductive performance as are the result of hopper density are associated with differences in morphological phase, and they alone can be regarded as manifestations of physiological phase characters.

The time elapsing between the emergence of the adults and the deposition of the first egg-pod was shorter in *solitaria* than in *gregaria*, even when both were isolated in pairs. Crowding during adult life greatly retarded maturation in *gregaria* but only slightly affected it in *solitaria.* The rate of oviposition was also slightly higher in *solitaria* than in isolated *gregaria* and very much higher than in crowded *gregaria.* Adult crowding retarded oviposition in *gregaria* and also tended to retard it in *solitaria,* though less regularly and only at a higher density than is necessary for retardation in *gregaria.* It is therefore apparent that greater susceptibility to adult crowding as manifested by retardation of maturation and oviposition is a phase character of *gregaria.* Feeding the locusts on an inferior type of grass retarded the rates of maturation and oviposition by *gregaria* still further, but did not affect those of *solitaria.* The mean total number of eggs laid by *solitaria* females was 497, whereas that of crowded *gregaria* was only 330 ; when the locusts were fed on poor quality grass, the figure for *gregaria* females was reduced to 280, but that for *solitaria* females remained at 497. The average number of pods laid by females of both types breeding in isolated pairs was approximately seven. The *gregaria* females lived longer than the *solitaria* females and so laid as many pods, despite their slower rate of maturation and oviposition ; when crowded during adult life they lived even longer and unless their density was very high, the average number of pods laid was only slightly, and possibly not significantly, longer. The duration of life of *solitaria* adults kept under crowded conditions and in consequence the number of pods that they laid, tended, on the contrary, to be reduced. The number of pods laid was not reduced in either *solitaria* or *gregaria* fed on poor quality grass.

The mean clutch (number of eggs per pod) was more closely related to environmental conditions than was the total number of pods laid. The mean clutch laid by females of either type breeding in isolation was 71. Crowding during adult life reduced this figure to 59 in *gregaria,* but did not reduce it in *solitaria.* An analysis of the relation between female weight within 24 hours of the last moult and clutch showed that the latter is a function of the former, irrespective of phase. The same was true of crowded *solitaria* females, but the clutch of crowded *gregaria* females was reduced even relative to weight. It is inferred that the detrimental effect of crowding on the number of eggs in the pods is the result of interference with feeding activities. This view is supported by the fact that feeding on poor grass increased the disparity between the phases in both weight and clutch. The mean clutch of poorly fed *gregaria* females was only 56 when breeding in isolation and 50 when crowded. The poorly fed *solitaria* females maintained a mean clutch of 71. Since there is no phase difference in the number of pods laid, any difference in fecundity between the phases is mainly determined by the number of eggs in each pod, and since *solitaria* females are in general larger than those of *gregaria,* it follows that their total fecundity will in general be greater, even where the latter are breeding in isolation.

It is concluded that under all circumstances, *solitaria* tends to be superior to *gregaria,* both in the number of eggs laid and the rate of laying. Its reproductive performance is, moreover, much less susceptible to adverse environmental factors such as inferior food and crowding during adult life.

Data are also given on the viability of the eggs, but it is not yet clear whether or not a phase difference exists in this respect.

Mossop (M. C.). **Control of Harvester Termites.**—*Rhod. agric. J.* **45** no. 2 pp. 114–118, 3 refs ; also as *Bull. Minist. Agric.* [*S. Rhod.*] no. 1440, 6 pp. Salisbury, S. Rhod., 1948.

In view of damage to pasture, wheat, oats and lucerne by harvester termites (*Hodotermes* spp.) in Southern Rhodesia, a brief account is given of their habits [*cf. R.A.E.*, A **23** 377] and the way in which they can be controlled by the use of a poison bait [**23** 676].

MOFFETT (A. A.). **The Use of Gammexane for the Control of White Grubs and Wire Worms in Tobacco Lands.**—*Rhod. agric. J.* **45** no. 2 pp. 132–146; also as *Bull. Minist. Agric.* [*S. Rhod.*] no. 1436, 16 pp. Salisbury, S. Rhod., 1948.

Following Mitchell's finding that γBHC (benzene hexachloride) showed promise for controlling white grubs (larvae of *Anomala, Schizonycha* and *Adoretus*) and false wireworms (*Psammodes similis* Péring.) in tobacco lands in Southern Rhodesia [*R.A.E.*, A **36** 137] but required application some weeks before planting to achieve its maximum effect [*cf.* **37** 278], further tests were carried out in the seasons of 1946–47 and 1947–48.

In 1946–47, two types of dust were used and these were diluted to contain 0·5–0·04 per cent. γBHC, broadcast at the rate of 300 lb. per acre on 20th November and dug in to a depth of 3–4 ins. Tobacco was not planted in the first series of plots, but counts of white grubs and *Psammodes* were made in sample areas on 8th January. One of the original two dusts proved better than the other against both sorts of insects, but both gave good control as compared with no treatment, and when the results were combined, there was no significant difference between BHC treatments against white grubs and none for 0·5–0·25 per cent. γBHC against *Psammodes*, though these were better than 0·08 per cent. and 0·08 than 0·04 per cent. The second series of plots was fertilised and planted with tobacco on 30th December. The stand of plants was examined after three weeks and the causes of losses established as far as possible. Both treatments gave good protection against damage by white grubs and *Psammodes*, with no significant differences between treatments for the former and none between 0·5–0·17 per cent. γ BHC for the latter. Unlike the first series, there was no difference between the two types of dust, which suggested that the larvae were rendered incapable of feeding if not actually killed. Losses due to the Tettigoniid, *Maxentius pinguis* (Wlk.), which amounted to 6·24 per cent. in the controls, were not affected. The same plots were again planted to tobacco in 1947–48 and examined for persistent effects. Stand counts showed similar results to those of the previous season, 0·5–0·17 per cent. γBHC permitting only about 2 per cent. loss of plants from causes other than *Maxentius* as compared with nearly 12 per cent. for no treatment, but 0·08 and 0·04 per cent. afforded no protection. The dust that had proved superior in insect counts in 1946–47 had a greater persistent effect than the other.

Since the broadcast treatment even at 0·25 per cent. γBHC would prove too expensive for ordinary use, localised treatment round the spot where each plant was to be set was compared with it in 1947–48, and treatments 1 and 33 days before planting were compared. The rate of application to the soil was the same as before in all cases, but the localised treatment required only 50 lb. dust per acre of field. The concentrations tested were 0·5, 0·25 and 0·08 per cent. γBHC. Three experiments were made, and their results on the plant stand are shown in tables. When they were combined, it was found that all treatments gave good protection from insects other than *Maxentius*, the percentages varying inversely with the concentrations, that late treatments were more effective than early treatments, and that broadcasting was little more effective than the localised treatment. The localised treatment with 0·25 per cent. γBHC was then tested to treat hills in which the plants had failed in a tobacco field that had already been replanted twice. In spite of bad weather, many of the plants subsequently set in these hills survived.

Since the high cost of BHC necessitates economy in its use, treatment should be related to anticipated attack. On new land, on which a good stand is usually obtained, localised treatment of hills in which plants fail should be sufficient, and this also applies to early plantings, which are normally less damaged, though preliminary treatment of the whole field may be desirable to ensure even growth of a good stand, since replanting in dry weather is impossible. If attack is expected to be heavy, a preliminary localised treatment of 0·25 per cent. γBHC should be made, followed by subsidiary treatment of hills where plants are missing. If a persistent effect is desired, broadcasting is more likely to be effective, unless the plants are set in the same hills each season.

HEAN (A. F.). **A South African Virus Disease of Crucifers.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 254, 15 pp., 5 figs., 29 refs. Pretoria [? 1947].

Investigations were made of a virus disease that attacks cauliflower, cabbage and stocks (*Matthiola incana*) in the Transvaal, especially in the neighbourhood of Pretoria. The symptoms, which are described for each plant, include stunting, leaf distortion, and vein-clearing and banding. The disease is most injurious in cauliflowers and the percentage of infection in them near Pretoria ranged from 5 to 75, as compared with 1–40 in cabbages and 2–15 in commercial plantings of stocks. The keeping quality of cabbage and cauliflower heads was impaired, and the flowers of the darker varieties of stocks were rendered unmarketable. Other plants to which the disease was transmitted by sap inoculation were turnip, broccoli, radish, wallflower and *Datura stramonium*, and the symptoms in each are summarised ; it could not be transmitted to brussels sprouts, garden nasturtium (*Tropaeolum majus*), *Antirrhinum majus*, pepper (*Capsicum annuum*), tomato, tobacco, and four other solanaceous plants. It was not transmitted to healthy plants by four lots of unidentified thrips collected on infected plants in the field, but was transmitted by three of seven similar lots of Aphids. Under experimental conditions, it was very readily transmitted by both *Myzus persicae* (Sulz.) and *Brevicoryne brassicae* (L.), which are the commonest species on crucifers in the Pretoria district, where batches of these Aphids from virus-free cultures were allowed to feed on infected plants for 2–24 hours, with or without a starvation period of two hours before or after the feed, and then transferred to healthy plants on which they were left for up to 24 hours. Cauliflower, cabbage and stocks were all infected by Aphid transmission, the symptoms usually appearing after about three weeks. The disease was not transmitted through seeds from infected stock plants.

A comparison of the symptoms and properties of this virus with those recorded in the literature for others that attack cauliflower and cabbage indicates that it cannot be definitely identified with any one of them.

PAPERS NOTICED BY TITLE ONLY.

LEKANDER (M.). **Skogsinsekternas uppträdande i Sverige under tiden 1741–1945.** [The Occurrence of Forest Insects in Sweden in the Period 1741–1945.]—*Medd. Skogsforskningsinst.* **39** no. 5, 207 pp., 2 maps, 270 refs. Stockholm, 1951. (With a Summary in French.)

FERRIS (G. F.). **Atlas of the Scale Insects of North America. Series V. The Pseudococcidae (Part I).**—11 × 8½ ins., vii + 278 pp., 108 figs., planographed. Stanford Univ. Pr., California ; London, G. Cumberlege, Oxford Univ. Pr., 1950. Price 60*s*. or $7.50. [*Cf. R.A.E.*, A **25** 595 ; **30** 152, 456.]

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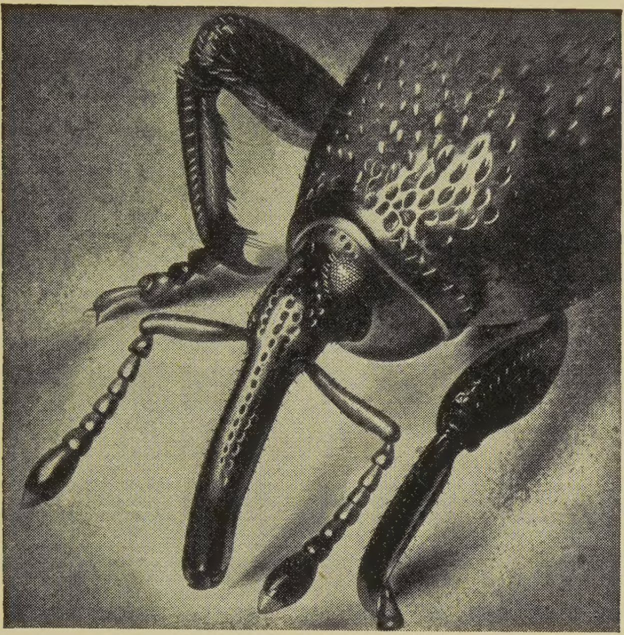

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